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NOTES AND COMMENTS

Colonial Sugar Refining Co. Ltd., 1957/58 Report.

The Company's seven Australian mills produced 275,200 tons of raw sugar from the cane harvested in 1957. This exceeded the previous record, made in 1954, by 20,100 tons.

For 1958 the crop prospects for the Company's Australian mills, and for the Australian industry generally, are good. However, owing to market restrictions under the International Sugar Agreement, it may not be possible to harvest the whole of the available cane.

Throughout the main growth period of the 1957 crop in Fiji weather conditions were favourable and the five mills (all C.S.R.) produced 196,100 tons of raw sugar, the highest outturn yet achieved in the Colony.

The cane for harvest in the coming season suffered a serious check in growth from the exceedingly dry conditions from last July until February this year. The normal wet season rains have been lacking, and growth generally is backward. A considerably higher acreage was put under cane for the 1958 harvest than for 1957, so the present estimate of 180,000 tons for the coming season is most disappointing.

RAW SUGAR PRODUCTION AT THE COMPANY'S MILLS
Tons Actual Sugar

	N.S.W.	Queensland	Fiji	Total
1953	33,000	202,800	191,000	426,800
1954	24,700	230,400	132,900	388,000
1955	34,800	196,200	163,100	394,100
1956	34,700	198,500	134,500	367,700
1957	35,600	239,600	196,100	471,300
1958 (forecast)	48,000	230,000	180,000	458,000

Sales of sugars and syrups from the five Australian refineries for the year ended 31st March 1958 were 510,000 tons compared with 485,000 tons in the previous year and 492,000 tons in 1956.

The Company is about to start packing refined sugar in retail packages for the grocery trade, and production and sale of a new grade of liquid sugar, particularly suitable for breweries, has commenced at the Sydney, Melbourne and Adelaide refineries.

In the last five years award wage rates at the Australian refineries increased by 16% but there has been a reduction of about 14% in the cost of refining per ton of sugar; this excludes the cost of bags for packing the sugar, which also came down in cost. Higher throughput helped a little, but this satisfactory result was brought about in the main by carefully considered improvements and additions to plant including instrumentation, by intensified supervision of process operations, by improved management techniques and by constant attention to various means of raising productivity.

Sales of refined sugar products from the Auckland refinery in New Zealand were 103,800 tons for the year ended 31st March, 1958. This quantity is a record and is 4·1% higher than for the previous year.

The bulk raw sugar unloading and receiving plant at Auckland refinery has been completed and the first cargo in bulk was received in April.

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Fifty Years of the Swedish Sugar Industry.[1]

In 1907, 9 refineries and 18 raw sugar factories combined to form the Svenska Sockerfabriks Aktiebolaget while another group of 1 refinery and 3 raw sugar factories was incorporated in 1936. At present the organization comprises 6 white sugar factories, namely Hasslarp, Karpalund, Köpingebro, Mörbylanga, Roma and Ortofta, with two refineries at Arlöv and Landskrona. Six raw sugar factories are at Göteborg, Hököpinge, Jordberga, Skivarp, Staffanstorp and Säbyholm. During the period 1907/16 the beet area of 31,800 hectares yielded 29·4 tons/ha of beet and 4·95 tons of sugar per ha. Corresponding figures for the period 1950/56 are 53,700 hectares, 33·6 tons beet/ha and 5·76 tons/ha of sugar.

Sugar production has risen from 126,600 tons in 1907/19 to 261,200 in 1948/56 although total sugar consumption has risen from 137,000 tons to 321,400 tons. Prior to mechanization and the introduction of monogerm seed, a labour force of 65,000 was required, but now this is reduced by half. The proportion of beets transported by road has increased considerably, from 30% of the crop in 1935 to 85% in 1956. Dextran production was started in 1947 and it is now sold both in Sweden and abroad. Industrial sugar is packed in cloth or paper bags of 25 or 50 kilos. Syrup production is about 25,000 tons per year.

[1] *Zeitsch. Zuckerind.*, 1958, **83**, 189–193.

South African Sugar, 1957/8.

To produce the record outturn of 959,872 tons of sugar, 8,594,618 tons of cane were crushed, giving a cane/sugar ratio of 8·95, which is the highest since the 1951/52 season.

An analysis of sugar production during the past five years shows that, with the exception of the 1956/57 season, production has increased annually by over 100,000 tons.

In an endeavour to cope with the vast cane crop which was available for harvesting, the crushing period of most mills had to be extended beyond the normal period. During the year several factors, such as the damage to the Tegula River Bridge and the continued shortage of S.A.R. personnel and engine power, interfered with the smooth movement of the cane to the factories. This not only caused inconvenience through periodic mill shutdowns but resulted in a high tonnage of cane being left in the fields unharvested. Moreover, it has been estimated that flood damage caused a reduction of 10,000 tons of sugar in the output of the Umfolozi mill alone.

The heavy flowering of cane caused much concern; then copious and persistent rains caused floods and washaways; and finally the collapse of a span of the Tegula River bridge changed the normal flow of about 1500 tons of sugar daily from mills north of the river into a mere trickle, and it also became necessary to divert to other mills cane which normally crosses the bridge.

From an industrial point of view, however, the heavy rainfall which continued from the previous season resulted in good growth of cane and has enhanced the prospects for the 1958/59 season.

The consumption of sugar during the season far exceeded expectations and during the year it became necessary to adjust the allocation for the domestic market by an increase of 10,000 tons of White sugar. The quantity would have been increased still further had the adjustment taken place in time to permit mills to produce according to the proposed new quota determinations. The final consumption for the season was 726,997 tons, an increase of 54,471 tons over the previous season. This represents an increase of approximately 8% as against a generally accepted figure of between 4% and 5%.

This exceptionally high rate of increase can possibly be attributed to the effect of the shortage of sugar during the three months before the commencement of the season, when it was necessary to control distribution without introducing any restriction.

Analysis of consumption trends suggests that it would be more accurate in the future to adopt a figure of 7% as being the normal annual rate of increased consumption as against the more conservative figure of 4%.

For a considerable number of years the Industry has experienced difficulty in producing sufficient White sugar to meet all the demands of the local market, but with the opening, last year, of the Sezela refinery and the impending opening of the Gledhow and Umfolozi refineries, coupled with increased output from the Hulsar refinery, the time has arrived when thoughts should be turned to developing a market for White sugar in neighbouring African territories, which may logically be regarded as the Industry's customers.

Although the crop for the season was 111,227 tons larger than the production for the previous season, less sugar was exported during the calendar year. This was due to several factors, chief among which were the need to allocate a substantially increased quantity to meet the abnormal offtake in the local market and to restore a depleted carryover. For the second year in succession the export surplus was insufficient to enable the Industry to fulfil the Negotiated Price Quota completely or make sugar available for the Free Market.

Details of surpluses available for exports, and actual exports during the past three years, are as follows:—

	1955/56	1956/57	1957/58
		(*short tons*)	
Production	938,980	848,645	959,872
Export surplus	266,097	162,220	207,240
		(*long tons*)	
Exports:			
N.P. Quota	157,000	155,939	130,098
Free Market	45,650	574	520
Rhodesia	27,000	24,300	32,400
	229,650	180,813	163,018
Shortfalls on quotas	49	52,237	78,118
Authorized quotas	229,699	233,050	241,136

The Experiment Station.—During the year under review the main research projects, as outlined in the programme of research, have been continued.

In sugar cane variety work, more than 40,000 seedlings from seed produced by crosses made at the Experiment Station were produced.

In fertilizer and plant nutrition research the series of exploratory trials commenced some years ago have now been augmented by the Regional Fertilizer Trial (R.F.T.) series, of which approximately 55 experiments will have been established by the end of the current year.

Due to indications that nematodes (eelworm) were possibly the cause of extremely unsatisfactory crops on so-called growth failure areas, particularly on the soils derived from recent sands in coastal areas, it was decided to give high priority to a research project dealing with this subject in the Entomology Department. Two field experiments have been planted to ascertain the effects of soil fumigants (EDB) on eelworms, and two similar experiments are being conducted by a miller-cum-planter in co-operation with the Experiment Station. The striking response to soil fumigation with EDB in a small pilot trial encourages belief that considerable low yielding areas may be corrected by such a treatment. As the chemical treatment is expensive, the possibility of biological control by means of stimulating the growth of predatory fungi is also being examined.

THE SUGAR CANE IN HAWAII

16th ANNUAL MEETING, HAWAIIAN SUGAR TECHNOLOGISTS, 1957.

Varieties

THE recent expedition to New Guinea and the Solomon Islands, organised by the Plant Introduction Section, U.S.D.A., is briefly noted by J. N. WARNER, one of its members. Civilization is encroaching rapidly on the area and much of the wealth of material, in the form of as yet un-harnessed genes, may well be lost. The conclusion drawn is that there is much work yet to be done in Dutch New Guinea and in the Sepik District of Australian New Guinea.

The problem of varietal yield decline is discussed by a team composed of J. P. MARTIN, plant pathologist, F. A. BIANCHI, entomologist, A. J. MANGELSDORF, geneticist and H. J. JENSEN, nematologist. The particular reference is to the decline which appears to be taking place in 37–1933, 44–3098 and 38–2915. The genetical argument is that recent work has shown the existence of as great a capacity to mutate among micro-organisms as among higher plants and animals. To meet the challenge, the geneticist must maintain the maximum of genetical diversity in his breeding material. Decentralized testing of varieties raised from this material will give a range of responses to different pathogen complexes and the life of so selected commercial varieties may be prolonged by periodic hot-water treatment. In the discussions on the biological aspects of the problem emphasis is laid on the damage caused by nematodes, of which six species have been identified, and the need for adapting control measures, sett treatment, soil fumigation and so on. It is curious that, among these measures, no mention is made of the "Friendly Fungi".[1] As a general guide to selection, should the need for replacement of the three above mentioned varieties become imperative, a statement of the position relative to the better of those varieties now under test is given by R. URATA.

Fertilization

Since its first bulk imporation to Hawaii in 1953, aqueous ammonia contributed two thirds of the total nitrogen purchased in 1956. Of such a volatile product there is always a danger of loss; there is also the question of the speed of nitrification. R. P. HUMBERT and A. S. AYRES review the investigations carried out on a variety of soils with different pH values. Volatilization losses were found to be low so long as the pH of the soil was 7·3 or below. Certain aspects of the very complex reactions of phosphate in its various forms when applied to the soil are discussed by the same two authors. All Hawaiian clay soils possess a substantial capacity for the retention of phosphate, but there is considerable variation in the speed of retention and in the availability of the phosphate so retained in the different soils.

Fertilization as practiced at Pioneer Mill Co. and at Pepeekeo Sugar Co. are described respectively by P. F. CONRAD and W. S. R. HUTCHINSON. The former plantation is irrigated and fertilizers are mainly applied in the irrigation water. All the latter is unirrigated and the methods are of special interest in that the earlier applications up to three months are made by machine with nitrogen in the form of aqueous ammonia while the later dressings, in which nitrogen is in the form of urea, are applied by aeroplane. With the use of CLEMENTS' crop log as guide, considerable increases in yield of sugar per acre have been obtained.

Irrigation

A number of investigations, carried out by the staff of the Hawaiian Commercial and Sugar Co. and design to ascertain the optimum method of using overhead irrigation, are described in a series of papers by members of that staff. Overhead irrigation as practiced in the United States, where some 4m acres are now so irrigated, is described by A. W. MCCULLOCH, and L. A. RICHARDS contributes a paper on water transmission and retention in soils.

Cultural Methods

From Waialua is adduced evidence that yields from reconditioned in-field road-ways have decreased from 108 tons cane/acre and 14·4 tons sugar/acre to 79 tons cane/acre and 10·9 tons sugar/acre. W. W. PATY approaches the subject from two directions. The first would reduce the damage to a minimum by keeping trucks off the fields, particularly during periods of heavy rain. Unfortunately, there is a limit to this method, as factories have to be fed. The second consists of subsoiling the truck lines parallel with the cane lines with the "Esco" ploughs especially spaced for the purpose. The account is, unfortunately, not readily understood without local knowledge.

Mechanical harvesting has introduced a new problem, not present in the days of hand-cutting when a heavy cover of trash was left on the field, in extensive erosion of the unprotected soil. The various methods adopted by the Hawaiian Agric. Co. to retain soil are detailed by P. KAHLBAUM, but the general opinion is that the only complete answer will be a harvesting machine which leaves the trash in the field.

In a paper by N. S. HANSON and J. BUMANGLAG the standards for testing herbicide efficiency are listed under three indices: pre-emergence, with five degrees, the first ranging from 0–50% control and the fifth from 95–100%; contact, ranging from (1) no effect to (5) complete control with plants dead or dying and, thirdly, cane effect with nine degrees

[1] *I.S.J.*, 1957, **59**, 319.

ranging from a stimulation giving double normal height, through no apparent effect to plants dead or dying. Brief notes are given on some of the more recently introduced herbicides.

A rather unusual problem, in the form of blockage of drains and ditches in swamp land by rank vegetation, has been sucessfully solved by the introduction of *Tilapia mossambica*, a fish indigenous to South Africa and carried thence to Indonesia and the Philippines where it is a source of food. The results obtained at Kekaha are described by H. M. HEE. An expenditure running to some $5,000 per annum has thereby been eliminated. *Tilapia*, a single pair of which is capable of producing 1·5m young per annum, is earning its keep!

H. M.-L.

DEVELOPMENTS IN CROP-LOGGING

THE use of the mineral content of plant tissues as a measure of the deficiencies of those minerals in the soil and of the fertilizer requirements has proved a valuable asset in economizing on the fertilizer bill and an improvement both on chemical analysis of the soil and on the lengthy and expensive plot experiment. But the method has not proved as simple and reliable as it at first appeared, an early difficulty lying in the selection of the most appropriate plant tissue. As familiarity grew, as the search for greater precision continued, cases were found where responses were not in accord with prediction. Not the least of these concerned the phosphorus requirement when the phosphorus index used in Hawaii—the P content of leaf sheaths 3–6 on a sugar-free, dry-weight basis—was the measure. An account of further investigations aiming at a resolution of these discrepancies and conducted by H. F. CLEMENTS is given in mimeograph form as Progress Notes No. 114 of the Experiment Station, College of Agriculture, University of Hawaii.[1]

In the search for factors affecting the P level in the plant tissue other than as supplied by the soil, the vigour of the plant was identified—a somewhat nebulous character but one which was capable of mathematical interpretation in terms of the tissue moisture and total sugar levels of the sheath tissue. A standard Phosphorus Index (SPI) is calculated from an equation expressing this relationship :

$$\underset{\text{(actual P Index)}}{\text{SPI}} = P_1 - 0{\cdot}004603\,\underset{\text{(Sheath Moisture Index)}}{M_1} - 0{\cdot}002715\,\underset{\text{(Total Sugar Index)}}{S_1} + 0{\cdot}40064$$

and has proved to give adequate prediction in the case of plant crops, but it too often predicts a demand for ratoons when, in practice, no identifiable response is obtained. From earlier data it had been concluded that the P level of a recently matured internode (5th) gave an accurate measure of the degree to which the phosphorus requirement of the moment was being met and, by incorporation of this index with the SPI, a combined Amplified Phosphorus Index has now been evolved from the multiplication of the SPI expressed in parts per 100,000 by the phosphorus level of the 5th internode similarly expressed and the product reported as a whole number in place of decimals. An API value of 1,800 to 2,000 indicates adequacy; if the API readings of a plant crop maintain adequacy, no phosphatic dressing of the ratoons will be necessary.

It is an observed fact that growth lost in the early stages by plant growing on zero P plots in soil deficient in phosphorus is often made good by harvest and the explanation appears to be that, as the root system expands, the plant gains access to an adequate supply from the normal phosphate content of the soil. Deficiency, thus, is a phenomenon of early growth and the suggestion is made that vacuum infiltration of a soluble phosphate into the cut seed pieces might be helpful.

The second part of the Progress Notes deals with a combined phosphorus and calcium experiment designed to answer the question whether, under conditions of very acid, low-calcium soil conditions, mixed rock phosphate and superphosphate can supply an adequate quantity of calcium. The harvest figures were not available at the time of writing but the Ca indices are given for four collections between July and December 1957. These indices show the extreme sensitivity of the leaf sheath to calcium treatments, the lack of any correlation between P and Ca levels, except in so far as the phosphate may be a calcium carrier, and a strong negative correlation between the Ca and K index.

H. M.-L.

Effect of Delayed Singling on the Yield of Sugar Beet. J. E. WHYBREW. *Experimental Husbandry*. (H.M. Stationery Office), 1958, (3), 49–53.—Trials were carried out at the Norfolk Agricultural Station to ascertain the effect of delayed singling or thinning out on the yield of sugar beet grown from braids of natural and rubbed seed. Rubbed seed gave higher yields than natural seed. Singling at 2-, 4- and 6-leaf stages gave similar yields. Singling a week after the 6-leaf stage reduced yields, especially from natural seed braids. Late singling had no effect on the sugar content of the roots. Higher plant populations were obtained from rubbed seed than from natural seed.

[1] Recent Developments in Crop-Logging of Sugar Cane—Phosphorus and Calcium.

THE SUGAR CANE IN AUSTRALIA

FIFTY-SEVENTH ANNUAL REPORT, BUREAU OF SUGAR EXPERIMENT STATIONS, 1957.

THE Report gives a summary of the investigations conducted during the year ending June 30th, 1957, and of the recommendations based on these, thus bringing into a connected whole a story, of which isolated incidents have previously appeared. Perhaps the story can best be expressed as a review of the various Divisional Reports which cut across those of the Station Reports and are covered by the Report of the Director.

Soils and Agronomy

The position with regard to fertilizers requires watching, for it is not static; a build-up of the nutrient status in the soil may take place so that the standard dressings recommended earlier may become excessive and uneconomic. Of particular interest is an experiment at the Mackay Station when no increase in yield was obtained on a soil of which the phosphate level had already increased beyond 60 p.p.m. as the result of previous dressings. Associated with this was evidence that the increase in phosphate was at the expense of potash.

A comparison between urea and sulphate of ammonia, as top dressing on an equivalent N basis, showed no superiority of one over the other either in yield or in storage. Since the former is available at lower unit cost, its use is recommended. Among minor elements, copper has given spectacular results on some poorer soils at Bundaberg and Mackay. Experiments on other areas exhibiting retarded growth and droopy top, a phenomenon generally associated with Cu deficiency, failed to show any response either to copper sulphate or copper in chelated form. Spraying with a weak solution of ferrous sulphate proved successful in the case of yellow patches in young ratoon cane which form a noticeable feature of fields in N. Queensland.

Soil Conservation

Work which has been taken over from the Queensland Department of Agriculture, and irrigation studies are briefly noted. The latter indicate that, from the minimum infiltration rate (determined by a ring infiltrometer), it is possible to calculate the rate of flow and the time required to supply a given amount of water, an increase of the former with corresponding decreases of the latter following a lime dressing.

Weed Control

Reeds (*Phragmites communis*) on low-lying lands have been controlled by "Dalapon" while convolvulus and "Star of Bethlehem" have been treated with 2,4–D. The giant sensitive plant (*Mimosa invisa*) is attacked with sodium pentachlorophenol. Phenoxyacetic acid types of herbicides are shown to be decomposed by soil organisms of which there appears to be a build-up, decomposition proceeding at a greater rate on soil previously treated.

The Southern Experiment Station reports on the permanent trash trial established there in 1933 that indications suggested that such benefit, as is derived from trash, was related to its potash content. The results obtained from a dressing of potash applied to the second ratoons of the fifth cycle (1954 harvest) not only confirmed this view but indicated that the deficiency is not rectified even on the trash plots. The figures are :—

	Trash Plots (tons cane)	No Trash Plots (tons cane)	Difference (tons cane)
13 harvests (1934–53)	414·1	409·5	4·6
2 harvests (1954–56)	86·6	78·6	8·0

Cane Breeding

New facilities include an electric soil sterilizer at Meringa and a 45 ft × 28 ft glass house at the Northern Station to replace the former house destroyed by a cyclone. A short flowering season, with the arrowing of certain varieties, e.g. Q57 and Q64, which rarely arrow, combined to produce a busy period in which 376 bi–parental crosses were made in addition to a poly-cross of 590 arrows from 43 varieties provding seed for bunch planting. Selection from earlier bunch plantings was severely interrupted by cyclone damage. I 233 has been raised to Q status as Q66 as a cane suitable for rich land where lodging is a danger; L469, too, the only variety to remain erect at the Northern Station, has been raised and re-numbered Q 67.

The varietal position and its trends are described in some detail but the immediate position shows little alteration with canes of Queensland origin supplying 81·3% of the crop, New Guinea canes 5·2% and U.S.A. canes 11·2%.

Entomology

The serious pests are the greyback (*Dermolepida albohirtum*) and the frenchi (*Lepidiota frenchi*) beetles. Control in the former case is rendered difficult by the variability in the extent and direction of the flights. The area dressed with BHC was 36,049 acres of plant cane plus ratoons hitherto not dressed, and some further 45,000 acres of ratoons were protected by residual effect.

BHC is also a protection against the frenchi beetle but it must be applied at planting to be effective. Hitherto the consobrina beetle (*Lepidiota consobrina*) has been grouped with the frenchi, in that it, too, had a two-year life cycle. At Mossman, it has caused damage in the autumn instead of spring, and it appears that it can, on occasion, shorten its life cycle.

Other insect pests on which notes are recorded are the funnel ant (*Aphaenogaster pythia*), the soldier fly (*Chiromyza rubriceps*) and the chrysomelid (*Rhyparida dimidiata*). Rats continue to do considerable damage, estimated at 40,000 tons, in spite of maintained control measures.

Pathology

The main features of ratoon stunting disease and of methods for its control are now sufficiently defined. Efforts are being made to determine its nature. It is accepted that it is a virus but attempts to concentrate and purify it by methods used for a number of other plant viruses have proved unsuccessful. Diffusion of the virus through an agar gel takes place, however, and differential concentrations in tissues, with maximum in mature leaves, have been found. At —20°C the virus can survive for 138 days with, however, a marked falling off in infectivity after 80–97 days. Artificial infection of a number of grasses including Para, *Cynodon dactylon*, guinea grass and wild sorghum (*S. verticilliflorum*) has been achieved; the hosts remain symptomless but from them retransmission to cane is readily effected. Other diseases which have caused trouble in the past are now well under control and are only briefly noted. Among these is a new and potentially serious disease which has made its appearance in the flood-liable areas of North Queensland. Characteristic are the swarms of flagellate rods in the diseased tissue which, with the chlorotic mottling of the young leaves, has led to the application of the name "bacterial mottle"[1].

H.M.-L.

THE CONTROL OF DISEASE

THE problem of disease control has many facets It may take the form of devising preventive measures against the introduction of an exotic disease into a country in which it is not known to occur, of eliminating a disease which is, or has become indigenous and of preventing its reintroduction, or of establishing races of the particular crop which are immune to attack. Examples of all these methods are to be found in the sugar cane industry. Hawaii is favourably placed through its isolation and, by a rigid control of importation of material, has successfully kept at bay exotic diseases ; but that isolation is a precarious protection in these days of the aeroplane and the added precaution is being taken of sending potential new varieties to Fiji for testing resistance to such diseases as Fiji and downy mildew under a joint scheme with the Colonial Sugar Refining Co. Ltd. of those islands. Queensland, which has perhaps more than its share of noxious diseases, has adopted the ambitious aim of complete elimination of the worst of these and has achieved remarkable success in this direction through Cane Pest and Disease Control Boards, the major weapon in the armoury of which is control over the varieties permitted to be grown in the different regions. It would be rash to say that complete elimination has been attained, for disease has a ready aptitude for lying latent, but the degree is such that, in cases, it has become possible to grow susceptible varieties in areas where, previously, serious infection was a certainty.

The latest country to adopt the ambitious project of disease elimination is Mauritius and it has the advantage, possessed by Hawaii, that it is isolated; though here, again, the aeroplane is breaking down this isolation and extra precautions have recently been adopted, particularly in view of the threat from Madagascar, where the presence of Fiji disease has been identified. The present project, however, is not concerned with the prevention of importation but with the elimination of an established disease. It is only three years since the presence of ratoon stunting disease was identified in Mauritius. In that period it has been shown to be generally endemic though in varying intensity. The ultimate goal is to secure one or more resistant varieties, but it is recognized that that is a matter of time ; meanwhile, hot water treatment is a proven remedy. The scheme now being put into operation is aimed at ensuring that only material rendered disease-free through such treatment shall be planted.

The area planted annually to cane is some 24,000 acres which, at 3·85 tons per acre, would involve the treatment of 92,000 tons cane if only directly treated cane were planted. It is recognized that such a task is impracticable and two stages are consequently envisaged. Initially a plant, now in course of construction, will treat 6400 tons cane, sufficient to plant up 1670 acres which will form nurseries distributed throughout the island. From these, planting material will be distributed for commercial propagation.

The scheme is described by R. Antoine[2] in an article which gives details of the central plant at Belle Rive and a list of local priorities based on the intensity in prevalence of the disease, this latter being a precautionary measure in the event of an inadequate supply of treated planting material.

Supervision of the plant has been entrusted to the Sugar Research Institute which is represented on the Committee of the Mauritius Sugar Planters' Association, the body responsible for the finance of the scheme and for the distribution among the large planters. The Department of Agriculture has charge of the nurseries and of distribution among small planters with finance from the Planters Rehabilitation Fund.

H. M.-L.

[1] *I.S.J.*, 1957, **59**, 174–175.
[2] *Rev. Agric. Sucr.* (Mauritius), 1958, **37**, 8–13.

Termites and Sugar Cane. ANON. *Ann. Rpt. Dept. Agric. Kenya*, 1956, **11**, 5.—Dipping planting setts in 0·1 per cent "Dieldrin" for 10 minutes before planting was better than B.H.C. dust treatment against termites, and doubled the yield. Untreated setts can be almost completely devoured whereas "Dieldrin"-treated setts produce a good stand.

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Sugar Cane Cultivation in Tanganyika. ANON. *Ann. Rpt. Dept. Agric., Tanganyika*, 1957, (1), 12.—There is still only one estate producing white sugar in Tanganyika—in the Moshi District. Production continues to increase, having gone up from an average of about 10,000 tons in the years 1952/55 to 18,000 tons in 1956 and a prospective 25,000 tons in 1958. The Company employs its own agronomist to improve sugar cultivation and water usage (the estate depends on irrigation) and also to endeavour to produce alternative rotation crops. The production of jaggery is mainly confined to the Eastern Province and the Bukoba District. Jaggery is marketed chiefly to sisal estates.

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A Key to the Identification of Sugarcane Borers. ANON. *Indian J. Entomology*, 1956, **18**, (3), 303–330.—This key makes it possible to identify or differentiate between the larvae of lepidoptera that bore into the stems of sugar-cane in India. The characters used may readily be observed in the field with the aid of a pocket lens.

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Sugar Cane Variety Trials in Kenya. ANON. *Ann. Rpt. Dept. Agric., Kenya*, 1956, **2**, 148–152.—Yields from ratoon crops of 16 varieties in a variety trial at Miwani showed Co 453 to be the outstanding variety, followed by Co 421 and Co 290. Trials with new varieties from the Kisumu cane collection showed Co 419 to be the most promising. N:Co 339 also did well as did Co 331, which is the variety recommended for planting at the present time.

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East African Quarantine Station. ANON. *Ann. Rpt. East Afr. Agric. and Fisheries Res. Council*, 1956–57, 17.—The East African Agriculture and Forestry Research Organization operates a plant quarantine station on behalf of the four East African Governments. Sugar cane is included among the principal plants passing through this station. For the 18-month period up to December 31st, 1957, nineteen varieties were received from Mount Edgecombe (Natal), Coimbatore (India) and Reduit (Mauritius), while twenty varieties were released to the Department of Agriculture in Uganda where they received heat treatment against ratoon stunting disease before being planted out, further quarantine for a year being maintained.

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The Creole Fly and the Borer. L. C. SCARAMUZZA. *Cubazúcar*, 1958, **3**, (5), 13–14.—A brief account is given of the latest sucess in control of the borer in Cuba through *Lixophaga diatraeae*, of which over 253,000 were bred and liberated in 1957.

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Outstanding Contributions of the Bureau of Plant Industry to the Sugar Cane Industry. E. E. CRUZ. *Sugar News* (Philippines), 1957, **33**, 463–467.—The Alunan cane, a hybrid of Java 247 and Badila, was bred at La Carlota, Occidental Negros, and released in 1927. Other contributions of the Bureau here recorded include control of root grubs by collection and by application of carbon bisulphide, D.D.T., etc.; of borers by *Trichogramma minutum* of which 516,000 were released between Nov. 1956 and Jan. 1957; of numerous other pests and of mosaic and red rot.

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Appraising the Performance of Sugar Cane Varieties at Pasumil. F. V. DEOMANO. *Sugar News* (Philippines), 1957, **33**, 468–472.—Juice analyses of a large number of varieties, taken at monthly intervals from November to March, are given in order to assist the selection of the optimal varieties for estate cultivation. At present H 37–1933 supplies 70·88% of the total crop milled, with POJ 3106 next at 8·54%. From 56·36% in 1950–51, POJ 2878 supplied only 3·97% of the crop; yet at 277 lb sugar/ton cane its yield was superior to that of H 37–1933 at 252 lb sugar/ton cane. HPCo–49–406 is a promising newer variety, not yet grown in commercial quantity.

* * *

"Trash Blanketing" of Sugar Cane. H. MARTIN-LEAKE. *Mother Earth*, 1958, **10**, 230–233.—Large discrepancies have been found in the response to trash blanketing in Australia and South Africa. In the former, little response has been obtained from long continued treatment; in the latter, the response has been remarkable.[1] An explanation for this divergence has yet to be found and the article attempts to indicate in what direction the reconciliation may be sought.

[1] *I.S.J.*, 1958, **60**, 223.

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THE "SPALDINLAB" HARDNESS MONITOR

An Apparatus for Automatically Detecting and Signalling undue Hardness in Boiler Feed Waters, Condensates, etc.

By Wm. H. PARKER, M.Sc., and G. M. BOND
(Chemical Control Service, British Sugar Corporation Ltd.)

DURING normal campaign operations in a beet sugar factory there is ample condensate of first class quality, containing practically no "hardness", available for boiler feed purposes. For starting-up and for shutting-down periods, however, and in emergencies and during the refining of raw sugar in the off-season, raw water has to be used. In such cases it is desirable, indeed essential, for this water to be treated to reduce the hardness to a minimum, especially if the supply has a high hardness content, if scaling-up of boilers etc., and excessive blowing-down (which is wasteful) are to be avoided.

The apparatus here described was designed primarily for automatic detection of an increase in the hardness of the water from a treatment plant beyond a pre-set figure and to give an alarm when this occurred. It is, in fact, the mechanization of the laboratory test using EDTA with "Solochrome Black" as the indicator, the end point, a change of colour from puce to slate blue, being viewed by a selenium photo-cell. No synchronous motors are used, the device being entirely automatic, and the frequency of the tests can be varied from one every 2 minutes to one every hour. Fig 1 shows the general arrangement.

The softened water is drip fed to Syphon A. This is constructed in "Perspex" with two special features namely, a narrow neck in order to obtain a quick rise in head and a clear cut start. The other point is the small narrow bored pocket at the base which freely admits the lower end of the syphon tube. This method completely drains the container within a few drops and gives a quick cut-off free from serious air entrainment. Specific details will be found in Fig 2.

These two features are necessary for two main reasons : (a) to keep the volume delivered (110 ml) constant and (b) to avoid a protracted air-entrained delivery time.

The syphoned water is collected in a "Perspex" chamber 'B' placed immediately underneath. Set inside this chamber are two contacts made in palladium foil (SW1). Across these contacts is a direct current of 50 volts in series with RL1. (see wiring diagram Fig. 3). The water thus passing these contacts will energize this relay, which in turn will open V1, V2, V3 and close V5. Ammonia buffer and "Solochrome Black" respectively are admitted by V1 and V2 at a pre-set rate of about 1 drop a second, nto the "Perspex" mixing chamber 'C'.

It will be noted that the water delivery tube to this chamber is inclined at 45° thus providing a swirling and mixing motion. At the same time V3 admits EDTA from the burette, from its zero setting, down to the setting predetermined by the operator. This will be referred to later. The reagents are admitted only while the syphon is in operation, and therefore, because the syphoning time is constant, so are the quantities of reagents added, except the EDTA which, as stated before, is pre-set in quantity. V5, which is the drain valve for the mixing chamber, is energised to close whilst syphoning is taking place.

It will now be seen that at the end of the syphoning, RL1 is de-energised, V1 and V2 close against the reagents, and V5 opens permitting the mixture to enter the inspection cell, V3 having been previously closed by SW2 via RL2.

RL1 is fitted with change-over contacts, and so, in its (normal) de-energised coil position, the second (change-over) contact will energise V4. This allows EDTA from the supply aspirator to enter the burette and thus the reagent rises up until it reaches a platinum wire probe SW3 set at the top of the burette.

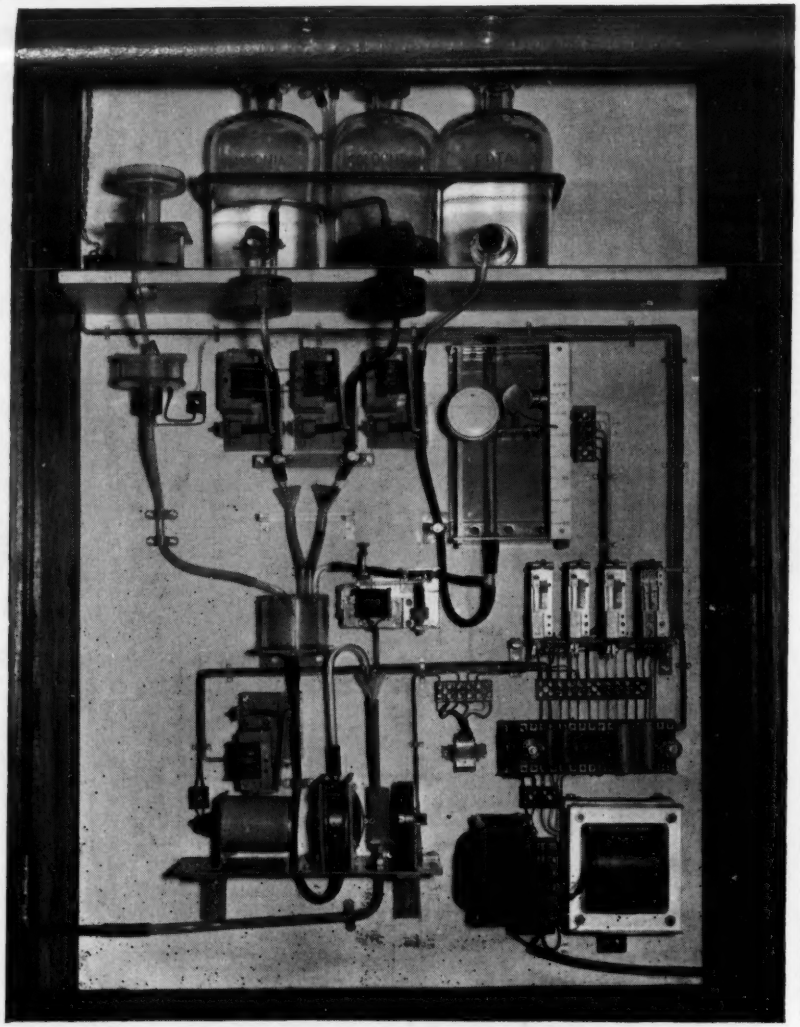
A 50 volt DC supply is in series with RL3 and the probe. The contacts of RL3 are normally closed, so that when EDTA solution makes contact with the probe SW3, RL3 is energised. This breaks the supply current to V4, and so stops the supply of EDTA to the burette.

The inspection cell is always full. At the end of each cycle, the liquor from the mixing chamber is allowed to displace slowly the previous liquid in the cell. A slow feed permits better displacement. A fast one would tend to short-circuit straight from the bottom inlet to the top outlet.

This cell has a capacity of about half that of the supply thus helping the displacement of the previous liquor, and is made from a "Perspex" body, glass side plates and brass clamps. A plano-convex lens is fitted on each side.

A 12V, 12W lamp is fixed at the focal point on the left and a selenium cell is fixed near the focal point on the right. Glued to the aperture of the selenium cells is a circle of Chances OR1 glass which transmits light at 0·65 microns and over.

Thus when the test sample is blue, no light will pass, but if the hardness rises, the consequent plum-coloured liquid will allow some light to pass to the cell. As the output of the selenium cell is very small



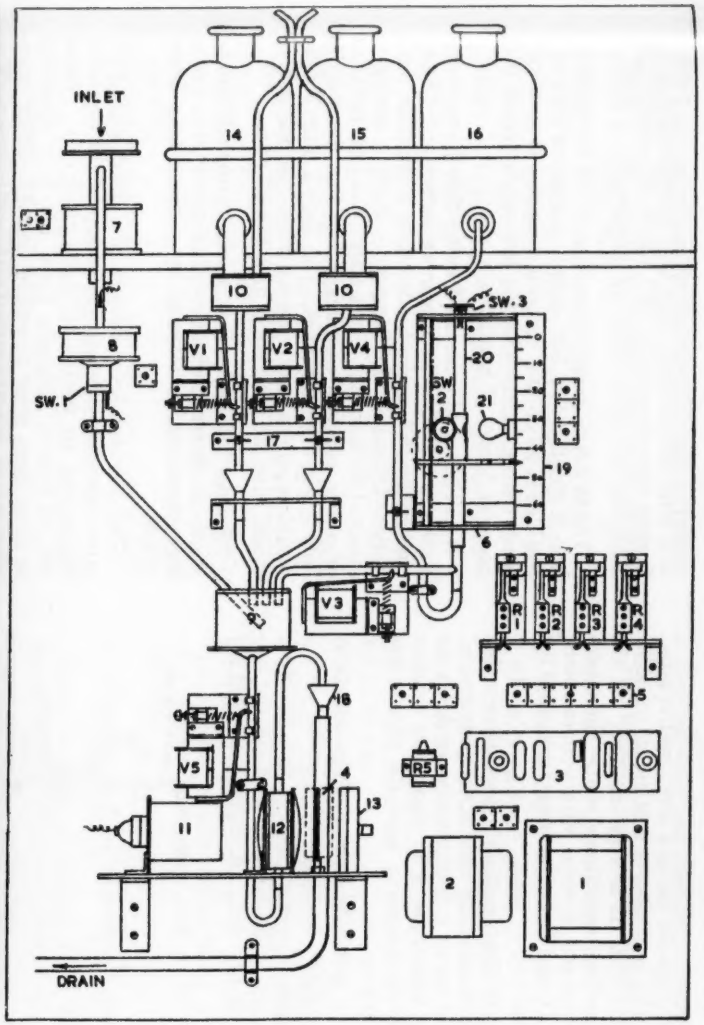


Fig 1. General Arrangement

KEY :

1. 50 V Transformer.
2. 12 V Ttransformer
3. Rectifying Panel
4. Shutter
5. Terminals Blocks
6. Automatic Burette
7. Syphon 'A'
8. Contact Chamber 'B'
9. Mixing Chamber 'C'
10. Const. Level Tank 'D'
11. Exciting Lamp
12. Inspection Cell
13. Photo-Cell
14. Ammonia Buffer
15. Solochrome Black
16. 0·02*N* EDTA
17. Pinchcocks
18. Funnels
19. Hardness Scale
20. Measuring Glass Tube
21. 12 V Bulb

SW.1 Switch No. 1
SW.2 „ No. 2
SW.3 Switch No. 3
V.1 Valve No. 1
V.2 „ No. 2
V.3 „ No. 3
V.4 „ No. 4
V.5 „ No. 5
R1-5 Relay Switches No. 1 to 5

indeed, it necessitates the use of a very sensitive relay. The one used here is a moving coil model made by Electro Methods Ltd. It is very sensitive, but the contact load must not exceed one watt. These contacts are therefore put in series with a more robust DC Relay (RLD) and its contacts are those used for the alarm device.

The quantity of light used on the selenium cell is arranged to be in excess of that actually necessary. This permits the use of a shutter to clamp down the light to a point where, say, a 30 p.p.m. test solution will just switch on the alarm when the burette has been set at 30 p.p.m.

This shutter is useful for operating the apparatus on circuits of voltages varying within limits.

Two transformers are fitted, one at 50 volt output and one at 12 volt. The latter is used for the two exciting lamps at 12V A.C. A tapping is taken off at 8 volts and rectified. This D.C. supply is fed to the burette photo-transistor SW2 which is in series with RL2, and also fed to RL4 via the contacts of RL5.

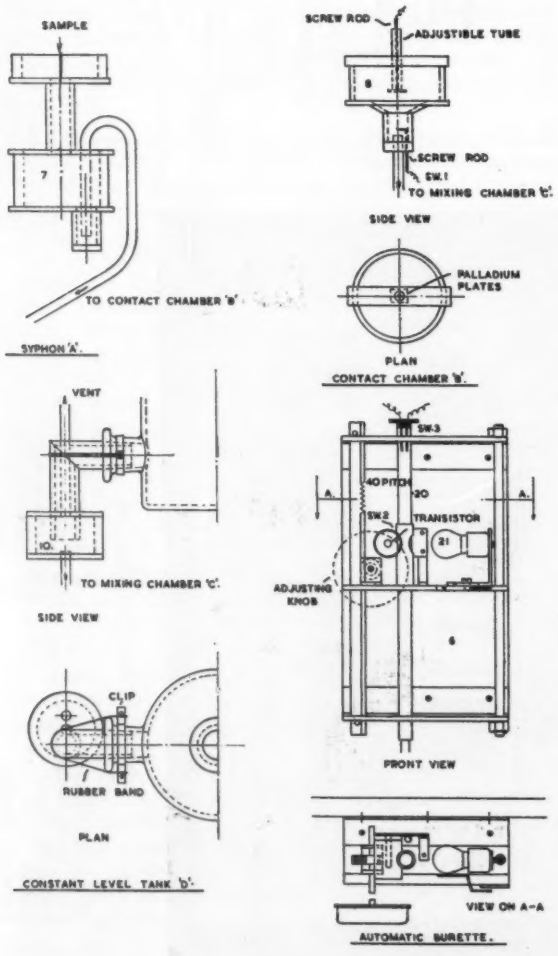


Fig 2.
Details of specific parts.

The 50V A.C. supply is used on all the valves V1 to V5. A rectified 50V D.C. supply is used for SWI and SW3, as it was found that this voltage was necessary when testing waters with the low conductances that occur at 5 ppm of hardness.

It will be noted from the drawing that the aspirator bottles containing the ammonia buffer and "Solochrome Black" are both fitted with a constant level device 'D' made of "Perspex". Such a device is essential to maintain a reasonably constant intensity of colour and will maintain a level that deviates by only $\pm\frac{1}{8}$ in from the mean. Too deep a plum colour would be equivalent to normal blue: too pale a blue would have the same effect as a normal puce.

"Perspex" is very easy to work. Extremely strong joints can be made with the aid of chloroform, and a high gloss can be attained by rubbing with brass polish.

The constant level devices are fitted with vent pipes extending upwards to the top of the aspirator bottles and are fitted with screw pinch clips. These are, of course, normally open, but it is advisable to close them prior to pulling out the rubber bung when filling the aspirators with new reagent. The pressure thus developed will prevent the levels from flooding.

With regard to the burette, mention has been made of the probe (SW3) fitted at the top, but a word about SW2 might be helpful. A 12 volt 6 watt lamp is mounted with the filament about 1 in away from the glass tube. The position of this is critical due to the short focal length of a glass tube filled with liquid. In line with and immediately behind the glass tube, a germanium photo-transistor is mounted in a $\frac{3}{4}$ in bore brass tube. This tube has a slit which is positioned between the light and the photo-cell.

The action is simple. With the burette full, light passes through the tube and the slit to the cell, and the current closes RL2 contacts, thus permitting V3 to open and pass EDTA to the mixing tank. This continues until the meniscus is in line with the slit. The photo-cell output drops, RL2 opens and V3 closes. The position of the cut-off point is made by turning a spring-loaded knob fixed to a rack and pinion. A pointer is mounted on the travelling slide and moves over a calibrated scale. The scale range is 0—60 p.p.m.

This apparatus has been tested at various points and its accuracy is better than 2 parts per million over the whole range. The various items are mounted on a "Formica"-covered nine-ply board and encased in a strong teak housing fitted with glass doors. Valves 1–5 are Londex Chassis type LF fitted with No. 41 Coil. A chisel-edged brass firm is fitted to the armature and is spring loaded to pinch the rubber tube.

SW1 (Switch 1)	is the contact chamber 'B' with palladium foil as the contacts.
SW2	is a germanium photo transistor Mullard type OCP 71.
SW3	is a small rubber bung fitted with two platinum wires projecting $\frac{1}{8}$ in below the narrow end, and is inserted into the top of the burette tube.
SW4	is a selenium photo-cell. (Evans Electro-selenium Ltd.)
RL1*	is a GPO-type relay with 2000 ohm coil and single pole change-over contacts.
RL*	Similar, but with 1000 ohm coil, energised to 'make'.
RL2*	Similar, but with 10,000 ohm coil, energised to 'break'.
RL4*	Similar, but with 1000 ohm coil, double-pole change-over.
RL5†	is a moving coil relay type 416 and is fitted with seven flying leads.

* The above relays are obtainable from the KEY-SWITCH Co. Ltd.

† Obtainable from Electro Methods Ltd., Caxton Way, Stevenage, Herts.

REAGENTS.

The reagents used must be prepared as follows :

1. *Titrating solution* 0·02*N* EDTA.

3·72 g of the crystalline dihydrate of ethylene-diamine tetra-acetic acid (disodium salt) are dissolved in distilled water and made up to 1 litre. 1 ml ≡ 1 mg $CaCO_3$.

The solution is checked against standard $CaCl_2$ solution. 25 ml $\frac{N}{28}$ $CaCl_2$ ≡ 44·63 ml 0·02*N* EDTA.

2. *Ammonia buffer solution.*

67·5 g NH_4Cl are added to 570 ml 0·880 NH_4OH and the mixture diluted with distilled water. It is stirred until the NH_4Cl has dissolved and made up to a volume of 950 ml.

0·616 g $MgSO_4 \cdot 7H_2O$ and 0·93 g EDTA solid reagent are dissolved in water and the volume made up to 50 ml.

The two solutions are mixed.

3. *Total Hardness Indicator Solutions.*

0·125 parts by weight of "Solochrome Black" are warmed with 100 parts by volume of industrial methylated spirit, so as to dissolve the dyestuff. The solution is allowed to stand overnight and is then filtered through a fine paper (e.g. Whatman No. 40).

4. *Standard calcium chloride solution* $\frac{N}{28}$.

Using a grade A burette 17·85 ml of accurately standardised *N* HCl are measured into a small beaker.

A small clean crystal of Iceland spar is dropped in. The beaker is immediately covered with a watch glass and allowed to stand overnight.

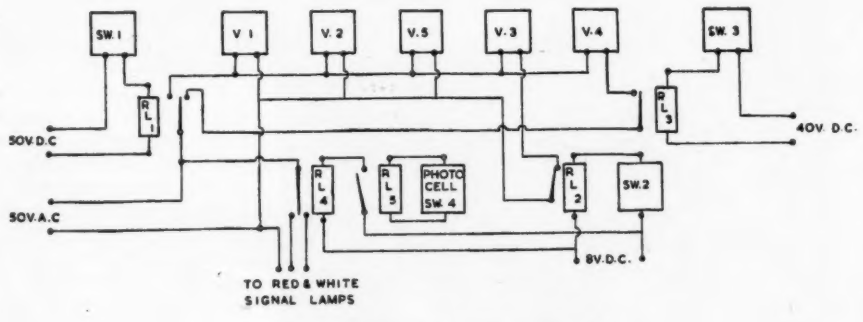
After boiling for about 5 minutes and cooling to room temperature, keeping the beaker covered, the solution is transferred quantitatively to a 500 ml graduated flask, retaining the undissolved portion of crystal in the beaker. It is washed with water and tested to ensure that the solution is neutral to methyl orange.

The flask is filled to the mark with distilled water and its contents mixed thoroughly.

This solution is used for standardising EDTA solutions.

The Authors wish to express their thanks to the Directors of British Sugar Corporation Limited for permission to publish this work.

WIRING DIAGRAM



WIRING OF POWER PACK

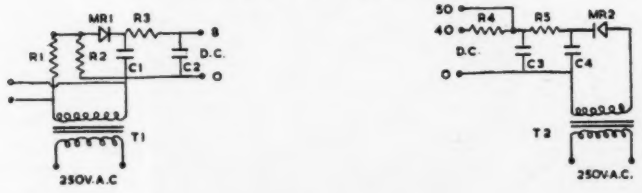


Fig 3.

Key to Power Supplies.

R1	75 ohm WW	C1	50 mfd	25 vWKG	MR1	1/6 A	Westinghouse
R2	25 ohm WW	C2	50 mfd	25 vWKG	MR2	2/12A	Westinghouse
R3	100 ohm 1w	C3	25 mfd	50 vWKG	T1	12 v 4 amp output	
R4	4700 ohm 1w	C4	25 mfd	50 vWKG	T2	50 v 2 amp output.	
R5	500 ohm WW						

BULK RAW SUGAR HANDLING IN TEXAS

NEW facilities for handling bulk raw sugar recently installed by the Imperial Sugar Company of Sugar Land, Texas, are in line with an industry-wide trend toward greater mechanization. Imperial began the changeover in its methods of handling raw sugar after signing a long-term contract (in 1956) through which the Texas refinery has access to large quantities of Hawaiian raw sugar shipped in bulk to Galveston. A raw sugar warehouse at Sugar Land and a completely mechanical system for unloading cargoes of bulk raw sugar at Galveston were completed and put into operation in mid-1957.

Now that its new dockside and warehousing facilities are completed, the Imperial plant has access to bulk raw sugar from the cane growing areas of both the Pacific (the Hawaiian Islands) and the Atlantic (principally Cuba and Puerto Rico), and is the only refinery in the United States not located on deep water that is equipped to handle 100 per cent of its raw sugar requirements in bulk form.

Under the old, cumbersome and expensive method of handling raw sugar by hand, at producing areas in Hawaii, the raw sugar was packed in jute bags and then, in a series of operations all requiring manual handling, was loaded into boxcars or trucks for the journey into Hawaiian ports, loaded into ships for the trip across the Pacific, unloaded into boxcars at Galveston, and finally unloaded at the refinery, 50 miles from dockside.

Now, all these operations are mechanized. The ocean freighters which formerly brought shipments of raw sugar in bags now arrive at Galveston's Pier 38 with their holds filled with loose, bulk raw sugar. A single ship may carry between 7500 and 13,000 tons, and one shipload supplies the Imperial refinery with enough raw sugar for 7 to 12 days of around-the-clock operation. From 30 to 35 shipments arrive annually, varying with sugar consumption.

To unload the bulk raw sugar from the vessel at the Galveston pier a two-rope grab (1¾ cubic yards in capacity) works in the square of each hatch, scooping up loose sugar from the hold of the ship. In the tween-decks of the ship, rubber-tyred front-end loaders (Allis Chalmers TL–6 with a 0·84 cubic yard bucket) shovel the sugar from the decks into the lower hold. Inside the hold, a dozer (Case Model 500 "Terra-A-Dozer", mounted on 14-inch steel grousers, 48-inch wide gauge) moves the sugar from the wings into the square of the hatch in reach of the grab. One dozer and one front-end loader are used in each hatch unless the hatch is so large that additional units must be used.

The grab operation entails the use of two winches, with the fall from one winch attached to the deadblock, and the other to the closing line of the grab. The starboard boom brings the grab over the square of the hatch for loading, and the port boom places it over the centre of a steel hopper on the pier to discharge. The grab is operated by two winchmen: one man who trips the locking mechanism, and one flagman.

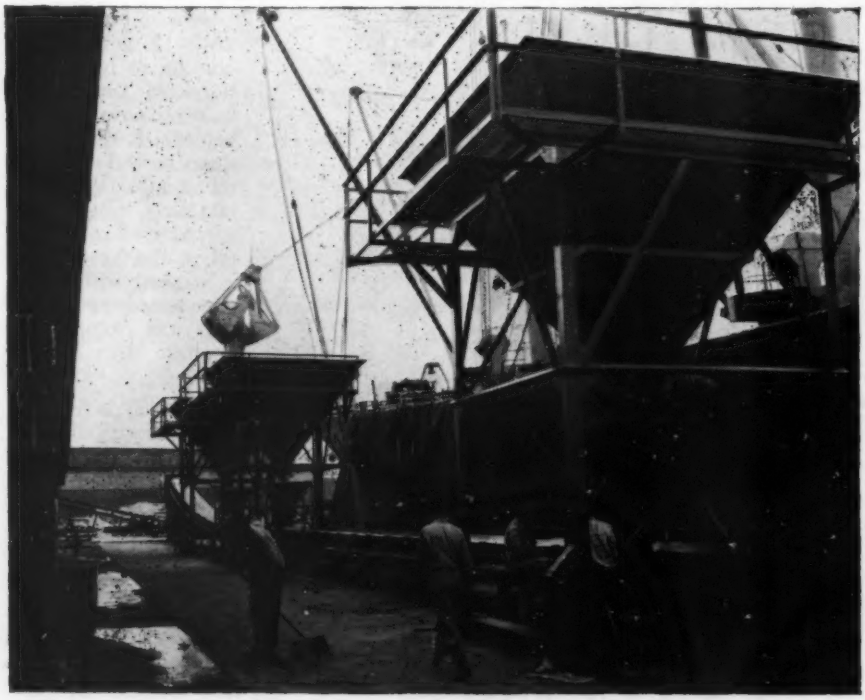


Fig. 1

Five funnel-shaped steel hoppers are permanent fixtures on the pier (Fig. 1). Each is located on the apron opposite a hatch so that five hatches may be unloaded simultaneously. (Dimensions of each hopper are as follows: 27 cubic yard capacity, 14 foot by 14 foot top reduced to a 10 foot by 10 foot square for a height of one foot, and attached to a 10 foot by 10 foot pyramid-shaped bottom of 7 foot vertical height, with a discharge gate, 18 inch by 18 inch, controlled by lever. The overall height of the hopper is 20 feet).

From the hoppers, the sugar is discharged by gravity to a 450-foot continuously moving conveyor belt (conveyor A in

Fig 2) a troughing type conveyor belt running parallel to the side of the ship. The belt is 42 inches wide, can carry 500 tons per hour, at 450 f.p.m. and is driven by a 40 h.p. electric motor.

At the south end of the apron, conveyor *A* discharges the sugar onto conveyor *B*, which runs at right angles to conveyor *A*. Conveyor *B* (a portable conveyor 36 inches by 46 feet) brings the sugar inside the dock shed to a third belt, conveyor *C*. As the sugar falls to conveyor *C*, a rotating mechanical arm reaches into the stream of sugar every 30 seconds to extract about two ounces for sampling. Conveyor *C* (36 inches by 68 feet) moves the sugar to the middle of the dock shed and discharges it onto conveyor *D* (36 inches by 80 feet), which runs at right angles to *C*.

Conveyor *D* moves the sugar north through the dock shed, and routes it into a two-way spout controlled by chain-driven rack-and-pinion gates. The sugar is usually divided equally between the two spouts—one leading to a carloading system at the south end of the dock shed, and the other, to conveyor *E* which connects with a similar carloading system on the north end. Each carloading system consists of a hopper, fitted over an inclined belt, which discharges into a two-way loading hopper, which in turn feeds a reversible belt. A car conveyor mounted on wheels can be placed at either end of the reversible belt to receive the sugar.

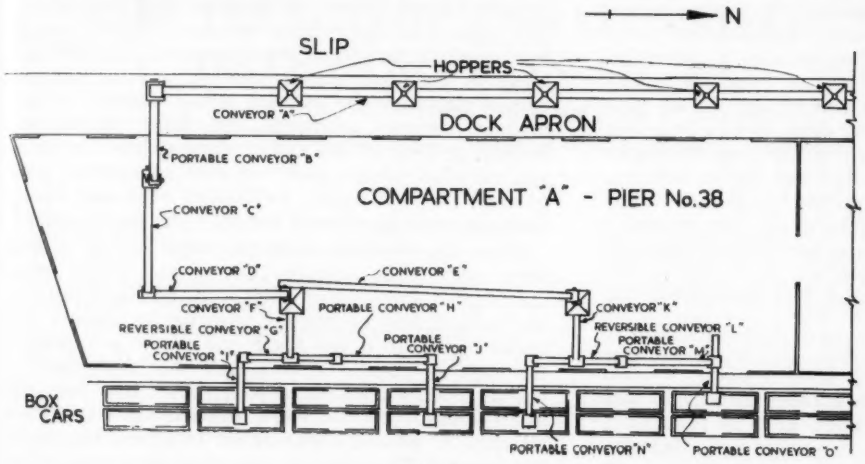


Fig. 2

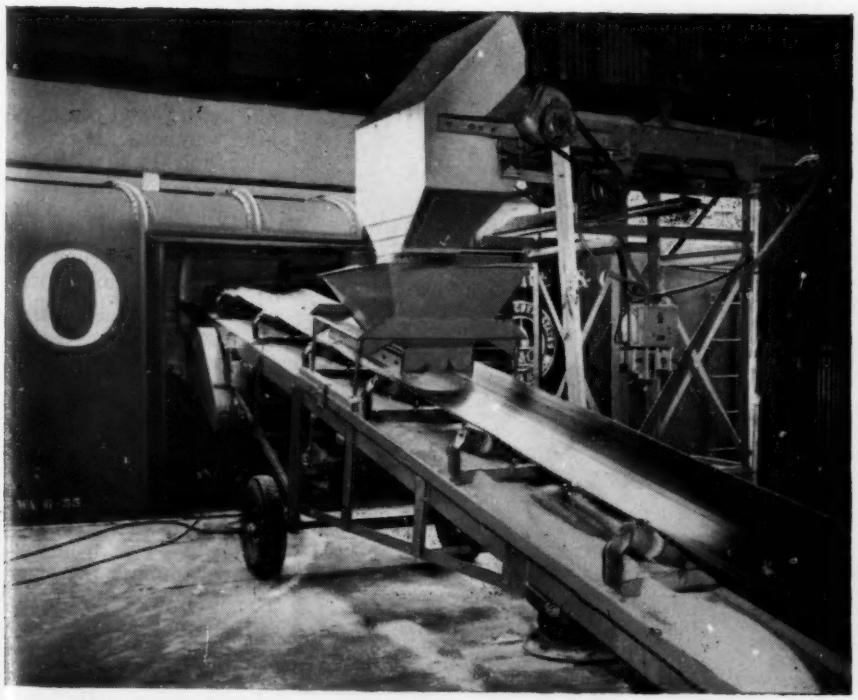


Fig. 3.

Dimensions of these units are as follows: receiving hopper, 8 cubic yards in capacity, with a 10 foot by 10 foot top tapered to a 20 inch by 4 foot bottom, mounted on four legs; inclined belt, 30 inches by 36 feet; two-way loading hopper feeds a 30 inch by 50 foot reversible belt which runs 8 feet above the floor. The portable car conveyor is 30 inches by 30 feet, mounted on 15 inch pneumatic tyres; its receiving hopper is 20 inches by 4 feet and adjustable to any position over the topside of the belt.

Two railroad tracks run parallel to the dock shed. The portable car conveyor can be placed in position to move sugar into boxcars on either track (Fig. 3). As the raw sugar enters the car it drops into a "slinger",

which hurls the sugar into both ends of the boxcar. (This is a Stephens-Adamson heavy duty 30-inch box car loader driven by a 7½ horsepower motor at 1,800 r.p.m.). The cars are filled to the ceiling at both ends, and the load of sugar tapers down to the floor at each side of the door opening, leaving the doorway free of sugar. Two cars are loaded simultaneously. By changing position of the portable conveyors, and by using extension conveyors, cars can be loaded at six points by each of the two car-loading systems. Thus 12 cars can be loaded before a switch of boxcars is required. The average vessel carrying raw sugar in five batches can be unloaded by Imperial's system at the rate of from 200 to 225 tons per hour, and at peak periods, up to 300 tons per hour. It takes three to four days, on a 16-hour-day work schedule, to unload an entire cargo of sugar. Since the sugar moves directly from ship to boxcars, the rate of carloading is governed by the rate of unloading. If carloading is delayed for any reason—such as delays in switching or mechanical failure of the carloading system—sugar can be moved to the concrete floor of the dock shed and then moved out later with "Payloaders".

The loaded boxcars, each holding about 100,000 pounds of bulk raw sugar, are linked into trains and sent to Imperial's refinery at Sugar Land for processing or storage. On the average, a trainload of raw sugar leaves Galveston each day for Sugar Land.

When the raw sugar is to go directly to the refinery for processing, the cars are brought alongside Imperial's wash plant to two dumping stations. Small payloaders, driven into the cars, push the sugar out and into an underground hopper, where it is started on its way through the refining process.

Any raw sugar above melt requirements goes to Imperial's ultra-modern warehouse. The warehouse, in which Imperial can store an immense stockpile, is one of the largest industrial buildings in the Southwestern United States. Its capacity is 20,000 tons of raw sugar. Its floor space measures 27,200 square feet, or about three-quarters of an acre. It is 340 feet long, 80 feet wide, and 60 feet high. Four boxcars of raw sugar can be emptied simultaneously at unloading stations alongside the huge warehouse. Receiving hoppers are set at ground level between two railroad tracks, and two cars are moved into position on each track. Payloaders push and dump the raw sugar from each car into the two hoppers.

From the receiving hoppers, sugar is fed to two belts running in opposite directions. These belts converge at a discharge point and the sugar falls to an inclined belt conveyor. Moving to another inclined conveyor at the north end of the warehouse, the sugar is carried upward half the height of the building, then transferred to another belt running in an opposite direction and taken to the top of the warehouse. Here it is transferred to a cross conveyor which takes it to a shuttle conveyor, from which the sugar falls evenly into the warehouse, forming an enormous pile that eventually reaches almost to the 60-foot ceiling. The shuttle conveyor, located at the top and centre of the warehouse, is reversible, and the sugar drops throughout the warehouse, settling against the concrete retaining walls as a base and assuming a normal angle of repose to the apex (Fig. 4).

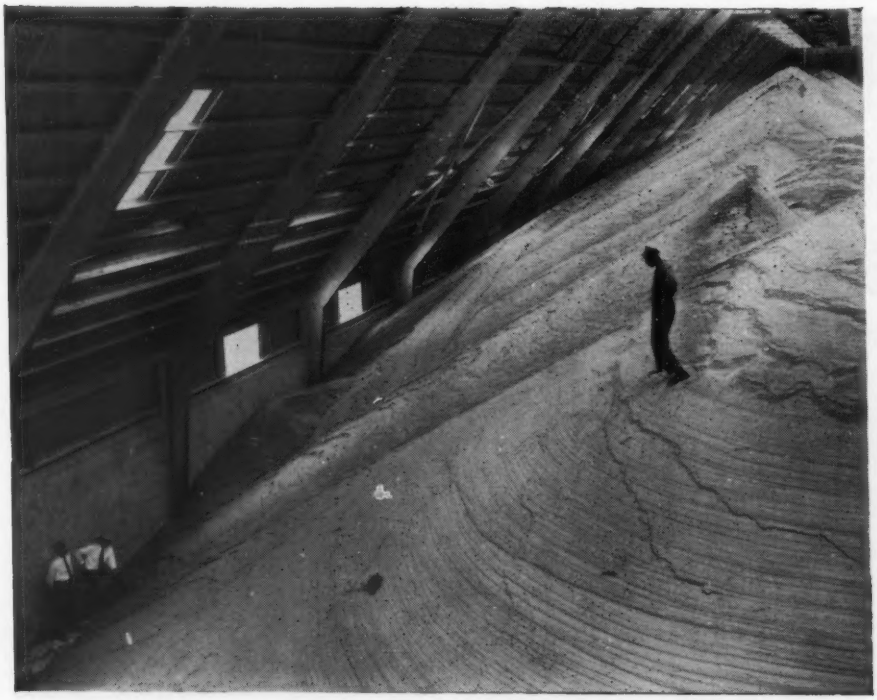


Fig. 4

Sugar is recovered from the warehouse by a conveyor belt running the length of the warehouse through a tunnel in the centre of the warehouse floor. This belt is fed by gravity through hopper feed gates set in the floor using a large front-end loader to move the sugar from the sides to the centre of the warehouse.

Imperial is now building a new $1,000,000 melt house immediately adjacent to the warehouse, and

upon completion of this unit all raw sugar will move directly into process through the bulk handling facilities of the raw sugar warehouse eliminating the use of the wash plant dumping stations. The new melt house will be completed late this year, at which time the 114 year old company will have what amounts to a completely new refinery, as a result of having invested more than $7,000,000 since 1947 in new buildings modernization and remodelling of other structures.

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THE EFFECT OF PARAFORMALDEHYDE ON DETERIORATION OF RAW SUGAR

I. R. SHERWOOD and Miss D. LLOYD.

(The Colonial Sugar Refining Co. Ltd., Sydney, Australia).

The rate of deterioration of raw sugar is governed largely by the following three factors:—

1. The temperature of storage of the sugar.
2. The moisture content of the sugar.
3. The microbiological condition of the sugar.

In general, it is not considered practicable to control the temperature of storage of raw sugar, since the refrigeration necessary for this purpose, especially under tropical conditions, is very costly.

Up to the present time, the most effective way of reducing the rate of deterioration of raw sugar has been found to lie in controlling factor No. 2—the moisture content of the sugar. The practical steps which have been taken to achieve this result are (*a*) the manufacture of a raw sugar of very low water content and (*b*) storage of sugar under conditions which minimize absorption of moisture.

Control of factor No. 3—the microbiological condition of the sugar—has posed many problems, since contamination of the sugar and process materials can occur at most stages of manufacture, whether from contact with equipment or air-borne dust[1], packing sacks[2], etc. One possible way of overcoming these difficulties would be through the addition of a suitable germicidal chemical to the raw sugar. Up to the present time, however, little success has attended efforts to find a suitable chemical, on account of the number of requirements which have to be met in an additive of this type.

The necessary properties include : (1) Efficacy; (2) Cheapness; (3) Moderate stability; (4) Low toxicity; (5) No deleterious effect on refining process; (6) Ready removal during refining; (7) No explosive properties; (8) Non-inflammability in the proportion used.

In 1941 ISBELL[3] suggested that sodium chlorite and calcium chlorite, recently made available in the United States in commercial quantities, would have useful properties for the control of microbial infection in sugar. ISBELL, however, acknowledged that an objectionable feature of chlorites was the danger of fire or explosion. Furthermore, it was found that the addition of chlorites to sugar led to an increase in the acidity of the sugar.

In some small scale trials which we carried out with sodium chlorite, this increase in acidity was found to be sufficiently high to produce an appreciable amount of inversion of the cane sugar.

Effect of Paraformaldehyde on Deterioration of Raw Sugar in the Laboratory

In searching for a more suitable additive to combat deterioration we gave consideration to the use of formalin. This material was known from laboratory tests to have marked fungicidal activity in sugar when added in the proportion of about 1 : 1000. There was, however, an obvious practical difficulty in the way of using formalin, viz. that of incorporating uniformly a small quantity of liquid in a large bulk of solid sugar.

It was while pondering this problem that we thought of the possibility of using paraformaldehyde in place of formalin. Here was an inexpensive, finely powdered solid conforming well to the requirements listed above, capable of ready incorporation in crystal sugar, and which slowly and continuously evolved formaldehyde gas. It seemed likely to us that the gaseous formaldehyde given off would tend to maintain fungicidal conditions within the sugar mass.

In order to determine whether this, in fact, would be the case, we carried out trials with the use of an accelerated deterioration test which had been developed some years earlier in this laboratory[4]. The procedure used consisted in incubating samples of raw sugar, with and without added paraformaldehyde, at 95°F and 100% relative humidity. For this purpose, the samples of sugar seeded with spores of *Aspergillus glaucus* were weighed aseptically into sterile glass jars loosely plugged with non-absorbent cotton wool and the jars

[1] SHERWOOD *et al.* : *Proc. 8th Congr. I.S.S.C.T.*, 1953, 820.
[2] Z. KAMERLING: Verslag over de botanische en physiologische Werkzaamheden Proefstat. V. Suikerind. in West Java. *Kapok*, 1899, **97**, 104.
[3] *J. Research N.B.S.*, 1941, **27**, 491.
[4] I. R. SHERWOOD and W. J. HINES: *Proc. 7th Congr. I.S.S.C.T.*, 1950, 591.

were then suspended over water in a chamber maintained at 95°F. After an incubation period of 14 days the samples were analysed. (Under these conditions, the sugars absorbed 8–12% or even more of water and suffered much more rapid deterioration than would sugar held under ordinary storage conditions).

A typical set of results obtained by use of this test is given in Table 1.

Table I

Effect of Paraformaldehyde on Deterioration of Raw Sugar.

Ratio of Paraformaldehyde to Sugar	Deterioration observed after 14 days at 100% R.H. and 95°F Decrease in Sucrose	Increase in Reducing Sugar
0 (Control)	12·69	11·39
	12·72	11·59
	12·64	10·74
	12·96	11·46
Av.	12·75	11·29
1 : 10,000	3·04	2·52
	3·04	2·54
	3·02	2·50
	3·06	2·48
Av.	3·04	2·51
1 : 20,000	3·06	2·70
	3·00	2·64
	3·04	2·64
	3·06	2·68
Av.	3·04	2·66
1 : 50,000	11·61	10·18
	12·06	10·46
	11·76	10·22
	11·70	10·20
Av.	11·78	10·26
1 : 100,000	11·18	9·61
	11·28	10·33
	11·20	9·78
	11·16	9·82
Av.	11·20	9·88

It will be seen from Table I that the addition of 1 part of paraformaldehyde to 20,000 parts of raw sugar was most effective in restraining deterioration under the laboratory conditions used, the treated sugar suffering only about one-quarter of the loss occurring in the untreated sugar. (Under the drastic storage conditions employed in these trials, even a sugar of excellent keeping quality would suffer some loss of sucrose. The loss of about 3% of sucrose occurring in the sugars containing 50 p.p.m. and 100 p.p.m. of paraformaldehyde would, from our experience with the test, characterise a sugar of superior keeping quality).

So far, our experimental results have been confined to the laboratory scale and no large scale trials have been carried out. It is not yet known, therefore, how effective paraformaldehyde will prove in restraining deterioration of sugar over long periods of storage.

Effect of Paraformaldehyde on the Micro-organisms in Raw Sugar

It is clear from the results given above that paraformaldehyde has a restraining, if not lethal, effect on some types of micro-organisms, e.g. *Aspergillus glaucus*. Cultural examination of the sugar showed that a marked reduction in the numbers of micro-organisms was brought about by the addition of paraformaldehyde. For example, a sample of raw sugar containing 50 p.p.m. of paraformaldehyde, when held at 86°F for 20 days, gave a count of mesophilic micro-organisms of 9 per g, as against 55 per g on a control sample of the same sugar held under the same conditions without addition of paraformaldehyde. The count of thermophilic spores per 10 g sugar was 110, as against 365 in the untreated sugar.

Rate of Disappearance of Paraformaldehyde from Treated Sugar

Work is not yet complete on the rate at which added paraformaldehyde is lost from raw sugar. The results obtained so far, however, indicate that paraformaldehyde, when added to raw sugar in the proportion of 50 p.p.m. is deploymerised almost completely within 12 days. The formaldehyde so produced then disappears at a rate governed by a number of factors, including the temperature. humidity and area of exposed surface.

The treated sugar has been found to have no noticeable foreign odour and the rate of evolution of formaldehyde from a pile of the sugar is not sufficiently rapid to lead to any build-up of a toxic atmosphere above the sugar. Consequently, there should be no health problem in the handling of sugar treated with paraformaldehyde.

Conclusion

The addition of 50 p.p.m. of paraformaldehyde to raw sugar is effective in restraining deterioration under very bad storage conditions. Treatment of sugar with paraformaldehyde leads to a marked reduction in the microflora, including thermophilic bacteria.

Acknowledgment

The authors wish to express their thanks to the management of The Colonial Sugar Refining Co. Ltd. for permission to publish this work.

El Salvador Production, 1958.[1]—Production this year is expected to amount to about 19,150 metric tons, according to the Bank of London and South America Ltd., which compares with final outturns of 21,170 tons and 16,511 tons in 1957 and 1956 respectively.

* * *

Argentina Sugar Crop, 1958.[2]—The first factory started crushing on the 15th April while 32 mills in Tucumán started on 5th May. This compares with only three mills crushing before the end of May in 1957. It is hoped that production this year will be much greater than last year's total of 656,927 tons which was severely reduced as a result of frost damage.

[1] C. Czarnikow Ltd., *Sugar Review*, 1958, (362), 120.
[2] *La Industria Argentina*, 1958, **64**, (4), 159.

Steam Conversion instead of Water-Softening Plant. J. SZADKOWSKI. *Gaz. Cukr.*, 1957, **59**, 267–268.—A description and flow-sheet are given of a closed water-steam circuit, using pre-softened water, which replaces an open circuit in which the water was periodically softened. A steam converter, installed in 1952, permits the steam-condensate flow circuit between boiler, turbines, steam converter and 1st evaporator effect to be closed and guarantees a regular supply of boiler feed. Fuel is saved despite complete replacement of water which has become contaminated with, for example, sugar.

* * *

Determination and Control of Supersaturation in High Purity Sugar Solutions. G. PIDOUX. *Ind. Alim. Agric.*, 1957, **74**, 621–626, 759–764.—The merits and demerits of the various methods of supersaturation determination are discussed and the conductimetric method suggested as the most suitable in view of its simplicity, accuracy and low cost. A patented conductivity meter is described and illustrated. The electrical resistance of the supersaturated solution is determined by a micro-ammeter graduated in supersaturation units. The special patented electrodes are located towards the bottom of the downtake. When the commutator is switched on, the corresponding juice valve opens to allow syrup to flow through a by-pass valve into the pan. After evaporation of the footing, a change-over switch is moved to "automatic" position and syrup flows into the pan until the supersaturation fixed by a potentiometer is reached. Coloured lights indicate the opening and closing of the valves. Two such instruments have operated continuously since 1953. The apparatus has a variance of less than 2μA.

* * *

Determination of Sugar Losses in Diluted Carbonatation Muds by L. I. Shapiro's Method. J. DOBRZYCKI. *Gaz. Cukr.*, 1957, **59**, 285–289.—SHAPIRO's indirect pol method, which is described in the official Polish "Instructions for Factory Control in Sugar Factories and Refineries" (Warsaw, 1951), is criticized on the grounds that fluctuating results are caused by errors in the determination of moisture content of the muds and by contamination of the dilution water by sugar. Calculations are given by way of example.

* * *

Tests on "Steelon" and Glass-Fibre Fabrics. T. MADZELEWSKI. *Gaz. Cukr.*, 1957, **59**, 300.—Tests were carried out on "Steelon" (Polish form of "Nylon") and glass-fibre filter-cloths, the former being used to filter 1st carbonatation, thin and thick juices, the latter for filtration of 1st carbonatation juice only. The glass-fibre was used as back-cloth with jute or "Steelon", and with jute or "Steelon" as back-cloths, two glass-fibre cloths being used in some tests. On their own they lasted only 3 days before shredding, and only a short period with the other cloths, whereas the "Steelon" cloths proved very efficient. The best arrangement was found with a jute back-cloth, the jute cloth lasting longer than the "Steelon".

* * *

Instrumentation of Sugar Factories. R. C. SHARMA. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 75–82.—Instruments in the sugar factory are surveyed and boiler-house efficiency discussed.

* * *

Indian Bentonite in Cane Juice Clarification. R. S. DUBEY. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 91–107.—Bentonite made alkaline by addition of Na_2CO_3 was used to clarify sulphited juice at pH 7·0. The juice was decanted after 2¾ hr settling and analysed. Results show good removal of Ca and improved clarity and juice purity. The bentonite had no effect on pH, but increased mud volume. Phosphated juice clarified with bentonite showed best clarity and lightest colour. Phosphate has greater effect on mud volume than bentonite, the effects on clarification and mud volume of both being additive. Juice treated with bentonite alone was better than that treated with phosphate only, the best juice being obtained when both were used. Trials at various factories showed, generally, that sugar quality improved and the increased mud volume was easily filtered. Khandsari and gur was of improved quality and kept better when bentonite was used. The economics of bentonite clarification are reviewed. Scale formed in evaporators, etc., is generally more easily removed.

* * *

Pan Boiling Scheme in a Double Carbonatation Factory. S. P. SANYAL. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 109–114.—The fundamentals of a 4-boiling system in a double carbonatation factory are discussed and minimum production of *C*-massecuite advocated. Formulae are developed to express the relationship between purity and quantity of a massecuite. In a 4-boiling system introduced in one factory in 1956/57 *A*- and *B*-massecuites were boiled on a seed magma composed of finished sugar and sulphited syrup mixed with *A* light molasses. Syrup mixed with *A* light molasses was fed into the pan and the first cut used in another pan to make *B*-massecuite by feeding with *A* heavy molasses. The massecuite in the first pan was boiled with syrup and *C* and *D* after-cured sugar melt. After a further cut both pans were fed with syrup and *C* and *D* melt.

C- and *D*-massecuite was grained on *A* heavy molasses with some syrup, using crushed and screened sugar as seed. The massecuite was developed with *B* heavy molasses (or *C* and *D* after-cure molasses when the *B*-molasses was of too high purity for *D*-boiling), and the pan, once full, was cut to another pan. This second pan was filled with *B* heavy and *C* and *D* after-cure molasses to form *C*-massecuite. The *D*-massecuite was formed in the first pan by feeding with *B* and later *C* heavy molasses. Alternatively, a second cut was made in the first pan to make two *D*-massecuites. The final product had a colour, brilliance and grain size better than the best classification given by the Indian Sugar Standard. Massecuite % Brix of mixed juice varied from 300 to 330. Detailed results are tabulated and compared with those from other factories.

* * *

Heat Balance of Massecuite Boiling. J. HRUBÍSEK. *Listy Cukr.*, 1957, **73**, 227–232.—Heat balance calculations are given for a raw sugar first product boiling in a UN 52 3890 standard pan of 45 tons capacity. The boiling was divided into two stages: (1) evaporation and concentration of the liquor with seeding, but no crystallization, and (2) development of the grain proper with syrup feeding. The heat requirements are calculated for each part of the boiling and the two added for the complete balance.

* * *

Studies on the Effect of "Versene" on Sugar Complexes. Possibility of Increasing the Exhaustibility of Molasses. S. N. G. RAO, N. A. RAMAIAH and S. K. D. AGARWAL. *Proc. 25th Conv. Indian Sugar Tech Assoc.*, 1957, 127–128.—The purity of 12 molasses samples increased by about 10 units on addition of EDTA, which also caused an increase in the pol. A study of the sugar complexes was made and fructose and sucrose found to combine considerably with Fe^{++}, Pb^{++}, etc. The increase in pol is attributed to the liberation of sucrose by EDTA, and it is suggested that an increase of sucrose corresponding to the 10 units purity rise would be available for crystallization if EDTA were added to the pan, resulting in less molasses.

* * *

Exhaustibility of Final Molasses in Cane Sugar Manufacture. S. P. SANYAL. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 137–142.—The factors affecting the exhaustibility of final molasses are discussed and the rôle of invert sugars, ash and gummy material in the molasses mentioned.

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Fondant Grain for Massecuite Seeding as Carried out at Darsana (Carew & Co. Ltd.). P. C. SEN. *Proc. 25th Conv. Indian Sugar Tech Assoc.*, 1957, 149–152.—A modification of APPLEBOOM'S method of preparing a non-aqueous fondant slurry[1] is described. One litre of a 60°Bx sugar solution is boiled to 114°C and 150 g liquid glucose are mixed in. The mixture is re-heated to 114°C and cooled to 90°C, poured into an aluminium basin, and cooled in a cold water bath with agitation. As soon as the syrup becomes milky and semi-stiff it is transferred to a 3-litre air-tight bottle, and 1400 cc of methylated spirit are added, 200 cc at a time. Conductivity readings were taken during the complete boiling of *A*, *B*, and *C*-massecuites. Advantages in the use of the new fondant include : strikes can be produced with little difference in grain size; the sugar clarity, colour and size are better than with the conventional seed boiling system; lower final molasses purity (30·8 for 1956/57 as opposed to 32·02 for the previous season); and easy curing of the massecuites, resulting in increased centrifugal capacity, six fore-workers and 4 after-workers being used for *C*-massecuite. Conductivity control was clearly found to improve pan boiling.

* * *

Studies on the Deterioration of Sugar during Storage in Godowns. N. A. RAMAIAH and V. S. RAMAN. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 153–165, 227–231.—Deterioration of sugar stored in godowns is discussed with 33 references to the literature. The primary cause is shown to be high R.H. and an apparatus for measuring the moisture content of the walls of the godown is described. This comprises two silver electrodes, anodised at the ends, which are connected in series to a 60 V battery. An incorporated "Avometer" covers 3 ranges of resistance, and measurements can be made up to 80 megohms. Good contact between the walls and the electrodes is ensured by dipping cotton cloths in KCl solution and attaching to the ends of the electrodes. The electrodes may be attached to poles to enable measurements to be made higher up the wall. Tests carried out with the apparatus in two godowns are described and results tabulated. It was found that resistance values increased with wall height, suggesting that moisture is sucked in from the floor or subsoil water along the capillaries in the cement plaster and is radiated into the atmosphere or godown at different heights. The rate of creepage and radiation set a limit to the moisture height so that the outside wall of one godown was dry at 7 ft above ground level, this height naturally increasing with increasing water level during the rainy season. Application of "Malthoid" bituminous compound to the floor and 5 ft up the wall is recommended, as well as across the wall thickness to prevent capillary suction of the moisture into the walls. The need to check for cracks and decay in bricks and/or plaster is emphasized.

* * *

Non-Sugars in Cane Juice. G. RAMCHANDER and T. S. RAO. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 167–173.—The composition of juice from cane grown under dry cultivation conditions in acid soils was studied and details are tabulated. High organic and inorganic non-sugars contents were found in the juice, and the effect of these on the manufacturing

[1] *I.S.J.*, 1956, **58**, 99.

processes is discussed with mention of the composition of clear juice and syrup and final molasses. The need to keep reducing sugars destruction to a minimum is underlined.

* * *

Further Experiments on the New Technique of Cane Juice Clarification. J. M. SAHA and D. L. N. RAO. *Proc. 25th Conv. Indian Sugar Tech Assoc.*, 1957, 175–184.—Development of the Saha–Jain method of clarification is discussed. Experiment has shown that heating final juice to temperatures below 195°F causes an increase in the CaO content; that 195–200°F is the most favourable temperature for purity rise; that the colour is lightest at 195°F; that the addition of triple superphosphate as settled solution does not affect the CaO content and gives slightly higher purity rise than in the form of slurry; that addition of the muddy juice to raw juice before heating gives higher purity rise (about 0·2 units increase) but also increases CaO content, so that it should be added to the limed and sulphited juice before this is made alkaline. The following proposed scheme is based on the results of these tests: raw juice at 160°F is pre-sulphited for 2–2½ min, after which 1·5% by volume of milk-of-lime (12°Bé) is added with simultaneous sulphitation, the pH being kept as near to 7·0 as possible. Muddy juice from the Dorr clarifiers is added continuously and the juice is then made alkaline to pH 10·5–10·7 with 1·66% by volume of milk-of-lime. Settled triple superphosphate at 0·08–0·1% on cane is continuously added to the filtered alkaline juice and neutralization is completed by adding SO_2 continuously. The juice is then heated to 195°F and sent to the clarifiers.

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Some Experiments on the Standard Sulphitation Process of Cane Juice Clarification. J. M. SAHA and D. L. N. RAO. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 185–194.—Experiments on the standard clarification method were carried out and the results are tabulated. It was found that triple superphosphate gives lower CaO content in the final juice when added to the unheated raw juice, addition of up to 0·015% on cane when natural phosphate content is <300 mg/litre being considered adequate for Northern Indian juices, and 0·01% when the P_2O_5 content is >300 mg/litre; no difference was encountered in adding superphosphate as slurry or as a settled solution; maximum purity rise is obtained at 200°F; pre-sulphitation or simultaneous liming with sulphitation of raw juice yields juices of almost identical purities and CaO contents, although that from pre-sulphitation is lighter in colour. Increased addition of lime gives juice of slightly lower CaO content and colour although 1·25% by volume of 12°Bé milk-of-lime is considered sufficient. The purity rise caused by increased additions of superphosphate is considered insufficient to warrant the increased cost.

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Clarification Efficiency. B. N. PANDEY and A. S. BHATIA. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 212–216.—The Clarification Factor (non-sugars % cane removed during clarification : non-sugars in mixed juice % cane) is discussed with respect to clarification efficiency calculation when *C* melt is being added to raw juice as in some carbonatation factories. The quantity of melt added to raw juice may be determined either by direct weighing in the measuring tank or by using analytical data of melt, raw juice and of the "melt-mixed" raw juice.

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The Sulphur Problem. R. S. DUBEY. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 217–225.—The production of sulphur and sulphur compounds from gypsum and pyrites in India is discussed and the Orkla smelting process described. In this, pyrites is mixed with coke, with silica and limestone as fluxing agents. Smelting is carried out in a water-jacketed shaft furnace, part of the sulphur being distilled off in the upper zone while FeS is oxidised to FeO and SO_2 in the smelting zone. The SO_2 is reduced to sulphur and CO_2 by the coke and the FeO converted into a silicate slag. The gases discharged at 450°C from the furnace top contain mostly sulphur, with small quantities of other sulphur compounds, which are converted to elemental sulphur by two-stage catalysis. The gases are finally scrubbed to free them of SO_2 and sent to the atmosphere. Copper, if any is present in the pyrites, is recoverable in pure form by smelting the copper-bearing slag and then electrolysing. Sulphur recovery is 85–86% and copper recovery 84–85%. An economic plant can process 300 tons of pyrites containing 41% sulphur every 24 hr. The economics are considered in detail. Other processes mentioned include the production of cement simultaneously with sulphuric acid from calcium sulphate as practised in the U.K. and the formation of sulphur from sewage sludge by bacterial action, which process is also being developed in the U.K.[1]

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Controlled Working of Filter Presses. S. CHANDRA. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 239–241.—Continuous filter-press operation using an automatic pressure recorder introduced at one factory in 1956/57 is described. Five or six presses are brought into operation one after another and the pressure kept at 15–20 p.s.i. Once 20 p.s.i. is exceeded another press is started up and the first press stopped for washing. In big factories two presses may be started and stopped at a time. Steam is used for sweetening-off before hot water, the wash water pumped to each press being recorded on an automatic level recorder. Sweetening-off in two stages reduces dilution by about one third, sweet-water from the second stage of the previous press being used first, the filtrate being added to juice going to process, followed by washing with hot condensate in the second stage. Results of one day's work show that for 98 presses washed per 24 hr the dilution was 7% on cane. Washing at 30–40 p.s.i. besides steaming one press at a time gives better exhaustion and drying of the filter-cake, and filtration at lower pressure ensures

[1] See *I.S.J.*, 1957, **59**, 203.

onger life for the filter-cloths, while a large filter area can be operated at any one time without increasing the number of presses.

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Index of Molasses Exhaustion (A Study of the Efficiency Status of Molasses Exhaustion in India). J. M. SAHA, D. L. N. RAO, V. SINGH amd N. C. VARMA. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 253–269.—Opinions in the literature on final molasses exhaustion are reviewed, and two methods of calculation are compared for Indian molasses. These are: (*a*) the Douwes-Dekker formula[1] and (*b*) the relationship determined in Hawaii, where purity of exhausted molasses is related to the ratio, total invert sugar : molasses ash content, in the form of a curve. Both are based on true purity and are found to be equally applicable in India, the Hawaiian ratio being preferable because of simplicity. The curve of minimum possible purity corresponding to invert : ash ratio has been extended to cover the lower values of the ratio prevalent in India. The minimum purities calculated from this curve are tabulated as well as the actual molasses exhaustion for Indian factories, which reveal widely fluctuating values from factory to factory and from month to month in the same factory. Analysis of 10 days' composite samples of final molasses is recommended to determine the factory exhaustion index, and the use of apparent purity as a guide to exhaustibility is condemned.

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On the Economics of "Purification of Molasses". S. N. G. RAO, S. L. PHANSALKER, N. A. RAMAIAH, K. H. RAO and S. C. JOLLY. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 315–323.—The process recently patented by DUBEY and SINGH[2] has been examined, and it is estimated from the purity rise obtained that 12 tons of clarified molasses of 52 purity can be obtained from 40 tons of 34 purity final molasses in a 1000-ton factory (4% on cane). The *s.j.m.* formula gives an estimated 2·97 tons of sugar obtainable from this. The economics of the process are considered, and it is concluded that the process is not profitable enough for commercial operation, especially in view of the heavy capital cost involved.

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Primary Treatment of Sugar Factory Effluents. S. N. G. RAO, J. P. SHUKLA and B. D. KAPUR. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 325–329.—The various methods of treating factory effluent are briefly reviewed. Various factory effluents are measured and these total 31·2 gal/t.c.h. on an average, with a maximum of 35·5. Tests with various flocculating agents have shown lime and aluminium sulphate to be the best, while bentonite reduces the settling time considerably. A process is described whereby a concentrated suspension of lime is added to give pH 10–10·5 and then enough aluminium sulphate or ferric chloride to reduce the pH to 7·0. After 10 minutes' flocculation and 1–2 hr settling the B.O.D. of the decanted liquid should be reduced by 50–60%. A pilot-plant test was carried out in which the effluent was conducted along drains to screens and grit-collecting tanks, whence it was taken by bucket elevator to the coagulation unit. The coagulants are mixed in with the effluent by bucket-and-chain elevator, the mixture then flowing by a zig-zag route to a continuous settler. The B.O.D. after 3 days was reduced from 1101 p.p.m. to 576 p.p.m. and the O.A. (15 min) from 370 p.p.m. to 149 p.p.m. with a drop in pH from 6·2 to 4·7. The process is not economical since 7·5 lb of quicklime and 4 lb of aluminium sulphate are used per 100 gallons. The need to reduce boiling house spillage (the major source of pollution) is emphasized.

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Moisture Absorption by Commercial Sugars in Warehouse. D. J. YANDE. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 331–332.—The moisture content of bagged sugar stored in a warehouse in 1955/56 was found to be caused by moisture absorption by the gunny bags. These were dried during the next season and found to contain 10–12·5% moisture on dry bag. If half this amount were absorbed by the 1 in layer of sugar immediately adjacent to the wall of the bag, the moisture content would be raised to 0·5% from 0·03–0·05%.

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New Filter Fabrics. I. A. RESCH. *J. Amer. Soc. Sugar Beet Tech.*, 1957, **9**, 476–478.—Tests carried out by the Spreckels Sugar Co. on synthetic filter cloths are described. The fabrics tested included: "Nylon", "Dynel", Orlon", "Vinyon" (with its French counterpart "Vincel") and "Dacron", with cotton twill as the control. "Vinyon N" was most suitable for hot saccharate and "Vinyon J-302" or "Vincel V-1902" for cold saccharate filtration; "Dynel" and "Orlon" were successful in Steffen filtration and "Dynel 2003" was found to be most efficient for carbonatation sludge when tested on a drum vacuum filter. A basket-weave light-weight cotton cloth "Style No. 15" has been found most suitable for carbonatation filtration, giving satisfactory filtrate clarity; it does not require acid scrubbing for at least the first week and less frequently after that than do the heavier twill and synthetic cloths.

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Developments of First Carbonatation Vacuum Filter Details. G. W. MILES. *J. Amer. Soc. Sugar Beet Tech.*, 1957, **9**, 515–520.—Modifications to first carbonatation rotary vacuum filters are discussed. Plastic paints are recommended for protective coatings and will, it is claimed, afford protection up to 400°F. Rigid rubber drainage grids are advocated, and a method of fitting these is described. Dressing the filters with 4 in spaced wire-wrap across the drum face is satisfactory and economical. The economics of all three modifications are discussed.

[1] *I.S.J.*, 1951, **53**, 222–224.
[2] *I.S.J.*, 1956, **58**, 16.

BEET FACTORY NOTES

Filtration Difficulties in the Acsi Sugar Factory in the 1956/57 Campaign. B. WEINRICH and K. JÁNOSFY. *Cukoripar*, 1957, **10**, 184–187; through *S.I.A.*, 1957, **19**, Abstr. 943.—The difficulties were caused by the processing of frozen and deteriorated beets, and by metabolism products of micro-organsms infecting water which had been continuously re-utilized, and which gave trouble despite the use of large amounts of sterilizing agents. The filtration was improved by using larger amounts of lime (up to 0·5%) for cold pre-liming, and by returning at least 25–30% of unfiltered saturation juice.

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Effect of Synthetic Flocculants on Settling Rate of Calcium Salts and Clay. H. J. FIEDLER. *Zeitsch. Zuckerind.*, 1957, **82**, 540–543, 589–593.—Tests on aqueous suspensions of calcium oxide, carbonate, phosphate and oxalate show that they are easily flocculated by "Separan 2610", a hydrolysed polyacrylamide. In a suspension of calcium carbonate the mean diameter of the aggregates was increased by "Separan" which was added after CO_2 to obtain rapid flocculation. Flocculation occured when "Separan" was added to suspensions of $CaCO_3$ in aqueous sugar solutions; it increased with increasing $CaCO_3$ concentration and was independent of sugar concentration over the range 1–10%. The floc size was smaller than with sugar-free suspensions. When $CaCO_3$ was precipitated from sugar solutions, the effect of "Separan" was markedly reduced by the sugar and was sometimes only appreciable after boiling. "HPAN" and "Krilium 6" caused intense flocculation, while increased concentrations of "VAMA" caused decreased flock size. Good flocculation and rapid settling occured when 5 mg/100 ml of "Separan" was added to suspensions which were then boiled for two minutes. Various flocculating agents were added to bentonite or kaolinite suspensions; these were agitated and stood for 24 hours. The mixtures were agitated for a further 5 minutes and settled for 1 hour, when the turbidity, sediment volume and floc size were measured. Results are given in graph form and show that the high mol. wt. polyacrylates and polyacrylamides have the greatest flocculating effect.

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Juice Purification with Ion-Exchange Resins. G. S. BENIN. *Sakhar. Prom.*, 1957, (12), 41–46.—The factors governing efficient use of ion-exchange resins for juice purification are discussed with reference to recent literature and factory data. The opinion of V. M. VOLKHVYANSKII[1] that existing resins are suitable is repudiated.

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The Effect of pH on Peptization of Pectins. K. D. ZHURA. *Sakhar. Prom.*, 1957, (12), 53–55.—Experiments show: that the optimal pH for minimum peptization of pectins in fresh cossettes is the same as or very nearly that of the pH of normal juice, i.e. pH 6·5–6·7; that of the pH given earlier[2] by SILIN as 5 for fresh healthy beet is inaccurate; and that alkaline condensates increase peptization of the pectins (although the pH of the diffusion juice obtained with such water possibly approaches the pH of normal beet juice, despite the fact that none of the increased amount of pectins is removed). For this reason the use of ammoniacal water for diffusion is not recommended and water acidified to pH 6·5–6·7 is preferable. In a footnote P. M. SILIN points out that for a final diffusion pH of 5, water of pH 2 is required, and that an initial pH of 5, at which peptization was earlier found to be at a minimum, corresponds to a final pH of 6·7 referred to above.

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Physico-Chemical Study of the Purification of Beet Juice. VI. Liberation of Calcium Pectate by Saturation with Carbon Dioxide. J. VASÁTKO, R. KOHN and Z. KOHNOVÁ. *Listy Cukr.*, 1957, **73**, 279–282.—Calcium pectate, prepared from apple and beet pectin, was suspended in water and sucrose solution, and treated with a number of reagents; of these only sodium carbonate caused decomposition of the pectate. The sucrose present had no effect. Oversaturation of 1st carbonatation juice to the pH of 2nd carbonatation juice in the presence of excess alkalinity causes the reaction of sodium carbonate with the calcium pectate or with similar insoluble salts which form a large part of the filter-press muds. The time for completion of the decomposition cannot be determined owing to its dependence primarily on the dissociation constants of the acids, on the effective natural alkalinity, on the solubilizing of the lime salts, and on the lime salts content of the juice.

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Automatic Control of 1st Carbonatation. S. ZAGRODZKI, W. WINIARSKI, K. SZCZUCKA and A. KOWALSKI. *Gaz. Cukr.*, 1957, **59**, 315–317.—The system of 1st carbonatation automatic control at Lublin factory is described. The pH of the juice is kept to within 10·8–11·2 by means of a differential pH meter, equipped with glass and antimony electrodes, which controls an impulse generator. Fluctuations in the juice pH are countered by regulating the openings of the gas valves in the two carbonatation vessels, and if necessary, that of the juice valve. For example, in the case of under-saturation (i.e. when the pH is too high) the impulses actuate a servomotor controlling the gas valve to the 2nd carbonatation vessel; should the complete opening of this valve prove inadequate, the gas valve to the 1st vessel (which feeds the 2nd) is opened, and as a last resort the juice valve is gradually closed, until the required pH is reached. Variations of 0·3 in the pH are indicated by lights, red denoting too high a pH and green too low. In the event of blockages, e.g. during filtration, an emergency circuit closes all juice and gas valves.

[1] *Sakhar. Prom.*, 1957, (7), 76–77.
[2] *Technology of Sugars.* (Moscow, 1950).

NEW BOOKS AND BULLETINS

Bibliography of Food. E. A. BAKER and D. J. FOSKETT. 331 pp; 6 × 9¾ in. (Butterworth's Scientific Publications, 4/5 Bell Yard, London W.C.2.; Academic Press Inc., New York). 1958. Price: 63s. 0d.; $11·00.

The sub-title of this work is "a select international bibliography of nutrition, food and beverage technology and distribution, 1936–56". A large proportion is devoted to general food supplies, distribution, nutrition, etc., but some 10 pages are concerned with sugar. This provides an extensive survey of publications on sugar which, however, is not complete, and contains a number of spelling errors. This is unfortunate since the value of such a compilation lies in its completeness and much time and effort has obviously been spent in collecting the records of all the periodical and technical publications referred to. Another drawback from the point of view of the sugar man is that material published by research and other organizations for the use of their own members is not listed; this would probably have required a great deal of space, however, if the sugar industry is typical with its national and regional *Proceedings*.

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Zuckerwirtschaftliches Taschenbuch 1958. (Economic Sugar Pocket Book). H. MOSOLFF and G. BRUHNS. 162 pp; 4 × 5¾ in. (Verlag Dr. Albert Bartens, Lückhoffstr. 16, Berlin-Nikolassee, Germany.). 1958. Price: DM 7.20.

The fifth edition of this handy publication follows the pattern of the 1957 edition; the first part contains 62 tables and 11 graphs covering the beet and cane crops of the individual countries of the world and non-centrifugal sugar production. Also included are data on sugar prices, world quotas under the International Sugar Agreement, per capita consumption in various countries, sugar deliveries, cost and other data for the U.S., the European Common Market, and East and West Germany.

The second part covers international and local agreements affecting the German sugar economy, while the third part gives names and address of German sugar organizations, importers and agencies, and information on West German sugar factories, a list of East German Factories, and a list of U.S. sugar companies.

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Annual Report of the Research Department, The Sugar Manufacturers' Association (of Jamaica) Ltd. 31 pp + Appendices; 8½ × 11 in. 1956.

Thirty-one pages is inadequate to give more than the briefest account of the many lines of investigation now in progress in Jamaica and in a necessarily briefer review it is impossible to give an adequate account of the progress made in each of those many lines and the conclusions drawn therefrom. That technical progress is better recorded in such documents as the Proceedings of the meetings of the B.W.I. Sugar Technologists' Association. As subjects lying outside the normal scope of experimental investigation but discussed here are the current limits of productivity and the trend of pol % cane, the latter study being undertaken in view of the impression, which has gained currency in some quarters, that a price is being paid for new varieties in a deterioration in quality. The subsequent Sections deal successively with irrigation and its control, particularly by PENMAN'S equation for open water evaporation, nutrition, cultural practices, varieties, diseases and pests.

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The Indian Sugar Industry (1956–57 Annual). M. P. GANDHI. cxix + 75 + 45 pp; 6½ × 9¾ in. (M. P. Gandhi & Co., Bombay 1, India.) 1958. Price: Rs. 6.00 (Rs. 7.00 inc. postage).

The latest in this series of yearbooks is again in three parts, of which the first includes a statistical section revised up to 31st March 1958, and giving 47 tables of data on sugar production, consumption, cane acreages, factory capacities, etc. The general section deals with topics such as sugar supplies, sugar machinery manufacture in India, new factories, distribution, cane prices, import duties, taxes, legislation, organizations, etc., and concludes with a list of important dates in the history of the Indian Sugar Industry.

The second part, a review of the sugar industry, is concerned with many aspects of the 1956/57 campaign—sugar production, gur and khandsari, cane prices, production costs, cane research, by-products, etc., while the third part, an Appendix, is a detailed list, by states, of the sugar mills and gur refineries operating in India and Pakistan during 1957. A further list includes the names and addresses, and capacities of new factories for which licences have been granted. This new volume will be most useful for anyone requiring detailed information on this industry, which is one of the largest in the world.

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Viscosities of Sucrose Solutions at various temperatures: Tables of Recalculated Values. J. F. SWINDELLS, C. F. SNYDER, R. C. HARDY and P. E. GOLDEN. 7 pp; 6 × 9 in. (National Bureau of Standards, U.S. Dept. of Commerce, Washington 25, D.C., U.S.A.) 1958. Price: 5 cents (+ 25% postage).

This supplement to Circular C440 of the N.B.S. contains revisions of tables of viscosities of sucrose solutions at various temperatures made necessary by a redetermination of the absolute viscosity of water at 20°C. The new tables are calculated on the new value of 1·0020 cp and, in addition, incorporate the more precise values obtained for the calibration constants of the viscometers used in the original measurements of sucrose on which the tables were largely based.

Laboratory Methods and Chemical Reports

A Few Observations on the Solubility Test of Sugar Cubes. N. A. RAMAIAH and S. K. D. AGARWAL. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 271–274.—The Sandera method of determining sugar cube solubility[1] by noting the time for six cubes to pass through a sieve immersed in water is criticised on the grounds that the time taken for the 6th cube to dissolve may be wrongly determined, as small amounts of sugar remain on the crosswires long after the cube has broken down. In a modification of this test a small weight, e.g. a brass disc, is placed on top of each cube and a glass tube placed around the cube and its disc so that the latter remains in the same position on top of the cube while the sugar dissolves. The breakdown time is noted when the 6th metal disc is lying flat on the mesh. Tests were carried out to compare the Sandera test with the modified test. The results of 20 determinations show that the breakdown time varies from 55 to 120 sec in the Sandera method, and from 32 to 40 sec in the modified version, while, in the original, 12 out of 20 readings varied by over 20% from the mean, whereas only 5 readings varied by over 10% in the modified test.

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Determination of the Chlorides, Sulphates and Insolubles in Sugars. N. A. RAMAIAH and —. VISHNU. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 275–277.—The Ambler & Byall method[2] was used to determine the chlorides in white sugars, while that of Ambler, Snider and Byall[3] was used to determine the sulphates. The insolubles were determined by dissolving 100 g of sugar in 100 ml of water, filtering, and washing the filter paper with hot water and drying in an oven at 70°C. The paper was then ignited in a weighed crucible and ashed, then weighed. Results show considerable chloride and sulphate impurities in most of the 43 samples tested, 36 containing >15 p.p.m. of chlorides and 35 containing > 70 p.p.m. sulphates. The insolubles content was negligible.

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Chemical Examination of Indian Bagasse. B. BISWAS. *Proc. 25th Conv. Indian Sugar Tech. Assoc.*, 1957, 305–314.—The literature on bagasse analysis is surveyed (36 references) and tests made on Indian bagasse are described. A 20-lb sample contained 48·5% moisture, the air-dry residue containing 6·6% hygroscopic moisture, 5·9% of water solubles, and 1·65% ash. Cellulose content was 53·78%, lignin 20·03%, pentosan 23·86%, and nitrogen 0·21%. The 1% NaOH solubles amounted to 20·82%. The α–, β–, and γ–cellulose distribution in fibre, pith and white bagasse is reported. A graph is drawn of the relationship between cane fibre content and the cellulose in bagasse using data reported from several countries.

Application of the Hand Refractometer in the Sugar Industry. II. Khandsari Sugar. S. C. SEN. and J. C. BHARGAVA. *Indian Sugar*, 1957, **7**, 461–466.—Statistical analysis of data gathered at the Indian Institute of Sugar Technology showed a strong positive relationship between Brix and pol of juice sampled from canes and khandsari recovery % cane. A few data observed from khandsari mills confirmed the application of tables drawn up from the regression equations.

* * *

Determination of Raffinose. S. OIKAWA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1957, **6**, 49–54.—The sucrose and raffinose contents of beet molasses samples were calculated using the equations from the double-polarization methods I and III of Jackson & Gillis, and that of Osborn & Zisch. The effects of ions present in beet molasses was determined by removing them with an ion-exchange resin followed by analysis without lead clarification. The raffinose % sucrose values were higher than those obtained with a lead-clarified molasses solution. Paper chromatography was also used to determine the raffinose content, *n*–propanol, ethyl acetate and water mixture (7:1:2) being used as developer. In addition the raffinose spot could be extracted from the chromatogram and measured colorimetrically with anthrone, good results being obtained when the reagent was cooled to make it stable.

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Method of Ash Determination in Japanese Sugar Refineries. K. KIMURA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1957, **6**, 55–59.—The numbers of refineries using particular methods, variations in analytical techniques, and products analysed by conductimetric means are surveyed.

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The Crystal Form Modification of Sucrose, Effected by the Presence of Inorganic Salts. M. KAMODA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1957, **6**, 60–71.—The effect of inorganic salts on sucrose crystal growth was studied by growing crystals in a liquor of 1·15 supersaturation in a thermostatically-controlled bath at 30°C ± 10°C with and without salts. Development along the *a*, *b* and *c* axes was compared by measuring with a micrometer. Sodium chloride, carbonate and phosphate, potassium nitrate, thiocyanate, chromate and phosphate, and cobalt sulphate depressed the growth

[1] *Z. Zuckerind. Czech. Rep.*, 1935/36, **60**, 233.
[2] *I.S.J.*, 1933, **35**, 126.
[3] *I.S.J.*, 1931, **33**, 515.

rates along the three axes, but did not affect the crystal form. Potassium bichromate, ferricyanide, and carbonate and copper sulphate and chloride depressed the rate along the *b* axis, tending to make quadratic crystals. Potassium chloride depressed the rates along the *a* and *c* axes, tending to make thin, narrow plates. In the presence of calcium chloride, magnesium sulphate and chloride, zinc chloride and manganese sulphate the growth rates in the three axial directions were promoted but had no effects on the crystal form modification. Ammonium nitrate considerably increased the growth rates along the *a* and *c* axes, tending to make quadratic crystals. Inorganic salts considerably influenced the crystal form of sucrose at the initial stage of crystal growth, i.e. the growth rates in the directions of the *a* and *c* axes were remarkably depressed up to 3 hr. All the inorganic salts examined had no remarkable effect on the growth ratio at two ends of the *b* axis, and did not cause any crystal habit modification.

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The Electron Micrographs of the Nipple-like protruberances on the Cleavage Faces of Sugar Crystals. M. KAMODA and T. YAMANE. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1957, **6**, 72–77.—*See I.S.J.*, 1958, **60**, 275.

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X-Ray Study of Sugar Crystals, following the Manufacture Processes. K. OBA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1957, **6**, 78–85.—The relationship between X-ray photographs of sugar crystals and the asterism of Laue spots are discussed. Only one of the photographs shows perfect Laue spots, the crystal having perfect structure without any defects in lattice structure and apparently having no stress. The other photographs show changes in the position of the spots, peripheral widening and asterism, and are classified into seven types according to the growth of the crystal mosaic structure. The X-ray photograph of a rock sugar crystal grown from refined hard sugar is compared with that of a rock sugar crystal grown from raw hard sugar. Both crystals show perfect Laue spots, from which it is deducted that the causes of crystal stress and mosaic structure formation in boiling are mainly physical and not chemical. The asterism in photographs of product crystals is more marked that in those of seed crystals, the least noticeable asterism of the Laue spots being found in the photograph of crystals boiled on 2nd sugar seeds. Thus the asterism of the Laue spots increases during the process of crystal growth in the pan and of mosaic structure of the crystal lattice.

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Filtrability of Taiwan Raw Sugar. The Technical Committee, Japan Sugar Refineries' Assoc. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1957, **6**, 110–113.—Filtrability data for Taiwan raw sugars have been supplied by two refineries and the filtrability has been shown to be almost half that of Cuban or Peruvian raws.

Pulp-Pressing Research 1955/57. R. CAROLAN. *Irish Sugar Co. Ltd. Res. Lab. Rpt.*, 1957, (37), 38pp.—Laboratory experiments were made using a new pulp press based on the design of A. BÄCKMAN.[1] This comprises a piston in a brass cylinder with a piece of factory pulp press screen at the bottom. The moisture content decreased with increased pressure (3–9 atm) and with increased pressing time (5–25 min), high values of both having the greatest effect. A standard pressure of 5 atm for 25 min was adopted for the laboratory. Slight variations in initial moisture content have little effect on the final content. High diffusion temperatures have an adverse effect on the pulp pressing, although they have no regular effect on initial moisture content. Low pH of the diffusion supply water is advantageous except at such a low pressure as 1 atm even at 25 min pressing time, although acidification by means of fermentation rather than with mineral acids can have adverse effect on pressing, and will, naturally, result in sugar losses, besides extra lime salts and molasses production due to low pH of the supply water. It is shown that the Irish pulp reacts more favourably to high pressures and long pressing times than does Swedish pulp. The cossettes diffused in the laboratory had better pressing properties than did the factory slices even when diffusion conditions were otherwise identical. This is attributed to the presence of fermentation acids in the factory pulp. Other things being equal, a thinner layer of pulp presses better than the thicker layer, as the liquid has less distance to travel to the exterior. Mixing is advocated to overcome the difficulty of pressing thick layers of pulp, despite the extra equipment needed. Addition of 0·1% or less $CaCl_2$ on water to the supply water in the laboratory will cause a drop of about 2 units in the pressed pulp moisture content. However, absorption of the Ca by the pulp releases K and Na by ion-exchange, which would increase the purity of molasses, so that it is suggested that pulp be first pressed without $CaCl_2$ addition, then sprayed with $CaCl_2$ and re-pressed, the small amount of water from the second pressing being discarded. The capital outlay involved might be justified by the fact that 2% less moisture in the pulp represents about £100 per day in fuel saved in a 3000-ton factory.

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Influence of Nitrogenous Fertilizers on the Nitrogen Constituents of Beetroots, in particular Glutamic Acid. J. DUBOURG, R. SAUNIER, and P. DEVILLERS. *Ind. Alim. Agric.*, 1957, **74**, 883–888.—Results of two series of experiments using different beet varieties and nitrogen fertilizer levels, etc. indicate that while application of increased amounts of fertilizer produces higher contents of glutamic acid they also lower the pol in beet, and increase the noxious nitrogen content. Hence, the amount of fertilizer applied must be limited to that optimum amount which will provide the highest yield of sugar per hectare.

[1] *Socker Handlingar* I, 1952, **8**, 25.

BY-PRODUCTS

Sucrose in Animal Feeding. J. L. HICKSON. *Sugar J.* (La.), 1957, **20,** (4), 14–19, 43.—The use of molasses as animal fodder is discussed with 27 references to the literature.

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High Test Syrups in Chick Rations. A. L. PALAFOX. *Sugar J.* (La.), 1957, **20,** (4), 22–23, 26.—In tests carried out by the university of Hawaii Agricultural Experiment Station Poultry Science Department on feed for chickens it was found that high test syrup was superior to cane final molasses in growth promotion of both cockerels and hens. Results of body weight and mortality analyses are tabulated, and tests are being continued on laying birds. The "livability" of chicks was not affected by feeding high test syrup.

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Feeding Sugar to Hogs to Cut Shipping Losses. M. C. HECK. *Sugar J.* (La.), **20,** (4), 32–33.—Pigs fed with brown sugar showed increased yield after shipping 250 miles to a terminal market. There was no additional shrinkage or loss in curing and smoking of hams and shoulder, and the quality of the pork was favourably affected by feeding sugar just before slaughtering.

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The Reich Process for Molasses Elaboration. G. T. REICH. *Sugar J.* (La.), 1957, **20,** (4), 38–39.—Molasses is diluted and treated with ammonium sulphate and sulphuric acid under such conditions of time, temperature, pH and concentration, that 80% of its lime content is precipitated as monoclinic crystalline calcium sulphate. The liquor is diluted and fermented with pure culture yeast to give alcohol and a high-grade yeast for fodder.

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Production of Aconitic Acid from Molasses. ANON. *Chem.-Ing.-Tech.*, 1957, **29,** 519; through S.I.A., 1957, 19, Abs. 681.—Molasses is diluted and acidified with dilute H_2SO_4, and centrifuged, and the aconitic acid is directly extracted with methyl ethyl ketone in a pseudo-countercurrent column. The residue is neutralized with lime, centrifuged (the solids being further treated), and evaporated to give aconitic acid-free molasses. The extract is evaporated, centrifuged, mixed with the centrifuged solids from the molasses side, decolorized and filtered; the aconitic acid is then recovered in a vacuum crystallizer, centrifuged and dried. A flow sheet is given. The yield of aconitic acid is more than 90%. The process is cheaper than that of Regna & Bruins with methanol or one by ion-exchanger treatment.

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Molasses Foam as a Special Type of Sugar factory Deposit. G. VAVRINECZ. *Cukoripar*, 1957, **10,** 128–129; through S.I.A., 1957, **19,** Abs. 760.—The foam, which may form a layer 0·5 to 3 m high in the tanks, has sp.gr. 0·7 and contains up to 50% of air bubbles in the molasses liquid phase, and is stabilized by the colloids present. The foam was examined by adding water, settling, filtering, washing and drying, and yielded a dark blue grey powder. After extraction with benzene, the defatted grey powder left was not sticky. Full analyses are tabulated. The foam contained 10% of fat, 40% of insoluble matter (rust, sand, etc.), 10% of lime, and 25% of oxalate, humins, saponins, etc . The foam can be used in fertilization or in animal fodder.

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An Investigation of Sugar Cane Cuticle Wax. D. H. S. HORN and M. MATIC. *J. Sci. Food Agric.*, 1957, **8,** 571–577.—The saponified cuticle wax was found to consist of an acid fraction containing some triene unsaturated acids, small amounts of hydrocarbons in the C_{27}–C_{31} range, and of lower and higher molecular weight substances including aliphatic alcohols (mainly *n*-octacosanol and $\alpha\beta$-unsaturated and saturated ketones). Some of these identified compounds are shown to be artefacts produced on heating and saponification of the original wax.

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Panorama of Sugar Cane By-Products. J. ROMAGOSA CRUSET. *Sugar y Azúcar*, 1957, **52,** (12), 38–39.—The Cuban plants, in existance or proposed, for conversion of bagasse to hardboard, paper pulp, briquettes, etc; fermentation of molasses to give alcohol and yeast; and extraction of wax from cachaza are surveyed.

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Method of Using Calcium Saccharate Obtained from Molasses Desugarization for the Manufacture of Lactic Acid. J. VASÁTKO, M. GÄRTNER and A. KLEINERTOVÁ. *Chem. Zvesti*, 1957, **11,** 293–309; through *S.I.A.*, 1957, **19,** Abs. 955.—Since the non-sugars in molasses cause low yields of lactic acid to be produced, it is recommended, on the basis of large-scale laboratory experiments, that the fermentation process should be applied to the purified sucrose solution obtained by the Steffen process. A Sankey diagram is given of the Steffen process, showing the increased yields obtained when the wash liquors are re-used for initial molasses dilution. The purified sucrose solution is fermented with *Lactobacillus Delbrückii.* The lactic acid is neutralized, during fermentation, by means of a part of the saturation muds from the Steffen process. The rest of the muds can be dried or used to make "V-K chalk". The liquor is finally clarified with lime, and the calcium lactate is crystallized from the filtered liquor after evaporating and cooling, and is filtered and washed with cold water. The lactate is decomposed with H_2SO_4, calcium sulphate is filtered off, and the solution is concentrated. The mother-liquor from the calcium lactate solution, with washings, is similarly processed to obtain a technical grade of lactic acid. A Sankey diagram of the process is given. The two grades of lactic acid contain 82% and 51·5% of acid, of purities 99·7 and 63% respectively. The total yield is about 85·4% on sugar, or 74·3% on molasses. These are better than the usual factory products. The process saves about two-thirds of the amount of molasses usually required, and reduces costs by about 30%.

UNITED STATES.

Sugar Cane Stubble Shaver. A. ZAYCO, of Victorias, Philippine Republic. **2,830,515.** 16th June, 1955; 15th April, 1958.

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Granular Adsorbent for Sugar Refining. E. P. BARRETT, assr. BAUGH & SONS CO., of Baltimore, Maryland, U.S.A. **2,831,818.** 8th February, 1955; 22nd April, 1958.—A mixture of 60–80% of steamed bone meal, 15–20% of clay (attapulgite) and 0–20% of a carbonizable organic material is rendered plastic by mixing with water (44–48 lb per 100 lb of solids) and then extruded into shapes which are fired in the substantial absence of air at a temperature below that at which the clay vitrifies. The granules so formed are substantially homogeneous, with more total pore volume in the radius range of 70–150 Angströms and with improved decolorising powers for sugar liquors compared with bone char or synthetic adsorbents made from basic calcium phosphates such as hydroxyapatite.

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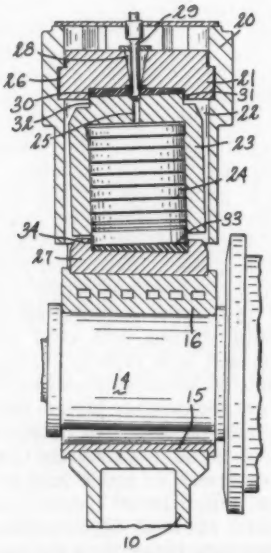
Floating Journal Boxes for Crushing Mills. P. HOLD and C. H. TREAT, assrs. FARREL-BIRMINGHAM CO. INC. of Ansonia, Conn., U.S.A. **2,832,280.** 2nd March, 1956; 29th April, 1958.—The top roller of a cane mill is mounted so that its shaft 14 and the surrounding bearing 15, 16 may move vertically along a ladder bearing and against hydraulic pressure. This pressure is applied through pipe 29 to a piston 24 which moves inside cylinder 23 and acts against the distributor plate 27. The cylinder is held against the head 21 which is locked in the cap by the bayonet fitting 26. Flexible rubber cushions 30, 33 are located between the cylinder 23 and head 21 and between piston 24 and plate 27; in addition, the head 21 has a conical opening for pipe 29 and the bearing cap 20 allows a clearance between its inside face and the outside of the cylinder 23. Consequently when the roller is tilted by the passage of an uneven blanket of cane, one side of each of the cushions is compressed more than the other and the cylinder 23 and pipe 29 are tilted with relation to the cap, while hydraulic pressure is maintain without any disturbance.



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Cane Loader. R. C. SHOEMAKER, assr. HYSTER CO., of Portland, Oregon, U.S.A. **2,833,429.** 7th January, 1955: 6th May, 1958.

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Beet Topper. H. F. HOWELL, assr. MASSEY-HARRIS-FERGUSON INC., of Racine, Wis., U.S.A. **2,834,176.** 23rd November, 1955; 13th May, 1958.

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Modified Mechano-Chemical Pulping. S. I. ARONOVSKY and E. C. LATHROP, assrs. U.S. SECRETARY OF AGRICULTURE. **2,835,574.** 13th July 1954; 20th May, 1958.—Bagasse is subjected to the action of a pulping liquor containing a reagent, e.g. NaOH, capable of digesting and removing lignin and other incrustants, at a temperature of 90–100°C at about atmospheric pressure, while simultaneusly subjecting individual pieces of bagasse to vigorous non-cutting blows while submerged in a relatively free state. These blows comprise a series of mechanically induced cycles of alternate compressions to express the liquor and expansions to permit absorbtion of fresh liquor. This beating continues for 5–20 minutes, followed by a quiescent period of 15–30 minutes to complete delignification, and followed by a further 1–20 minutes to homogenise and defibre the bagasse.

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Mixing Molasses with Feed. E. M. WETMORE, of Tonkawa, Okla., U.S.A. **2,836,211.** 27th February, 1956; 27th May, 1958.—A rotating knife for comminuting cattle feed revolves in a hammer mill at

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 2s each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

such a speed as to create a turbulent zone around itself. The feed is admitted into the mill by an inlet and molasses is sprayed under pressure into the turbulent zone with it for mixing with the feed.

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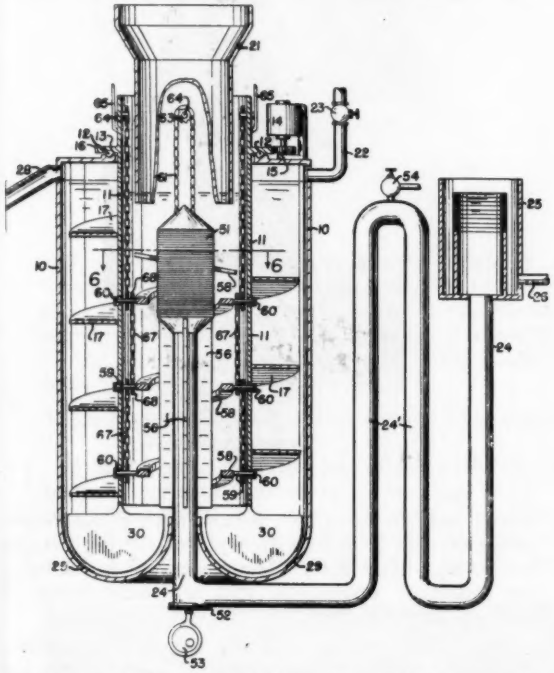
Beet Diffuser. J. P. RUTH, of Denver, Colo., U.S.A. **2,836,519.** 16th January, 1956; 27th May, 1958.—Cossettes enter through the hopper 21 into a rotating well 11 which carries conveyor scroll segments 58 on its inner surface and a scroll 17 on its outer surface as well as blades 30 moving in the annular trough formed in the base of the outer chamber 10. The cossettes are carried downwards through the well and thence, under the action of blades 30, into the outer chamber 10 where they are carried up by scroll 17



and discharged through pipe 28. Fresh water is admitted to the outer chamber by valve 23 and flows by gravity, counter-current to the cossettes to be discharged through the trap 51, into exit pipe 24 and weir trap 25 to pipe line 26 to process.

The scroll sections 58 pivot about their centre shafts 59 as the sprockets mounted with them are turned by means of chains 61, 67, 68, in response to movement of the external actuating arms 65. The positioning of the sections 58 is selected to obtain the minimum entrainment of fresh cossettes by the juice trap 51 and to conduct them down the well 11. A flexible diaphragm 52 at the bottom of pipe 24 is moved up and down by an eccentric 53 which imparts a pulsating movement to the juice column which tends to dislodge material from the outside of the trap.

Bagasse Concrete. A. C. MILLER and N. FISHMAN, assrs. HAWAIIAN DEVELOPMENT CO. LTD., of Honolulu, Hawaii. **2,837,435.** 15th November, 1955; 3rd June, 1958.—A lightweight concrete has the following composition: 100 parts (dry weight) of shredded bagasse containing polysaccharides; 100–400 (200) parts of Portland cement; 20–160 (160) parts of hydrated lime; 2–30 parts of a water-soluble polyvalent metal salt activator [a salt of Al or Fe or 5–50 parts (20 parts) $CaCl_2$]; 20–200 (80) parts of a pozzolan (diatomaceous earth or a pumicite), and water to give consistency. The cement when formed as a wet mass to the desired shape is cured in a moist atmosphere at 120–150°F for 24 hours.

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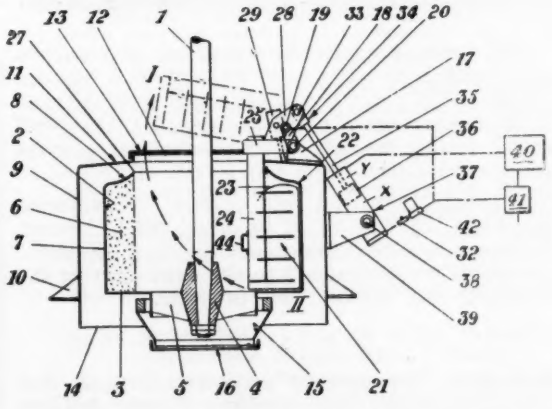
UNITED KINGDOM

Scraper Blades for Centrifugals. OFFICINE MECCANICHE E FONDERIE A. BOSCO S.P.A., of Terni, Italy. **797,410.** 12th September, 1956; 2nd July, 1958—Sugar 6 separated in the basket 2 of the centrifugal is removed by means of a scraper blade 21 which moves about pivot 20 mounted on the support 17. The "up" and "operating" positions are indicated at I and II. The movement of the blade is controlled in steps so that sugar is removed in layers and is actuated pneumatically by the movement of a piston inside cylinder X and connected to the scraper by a suitable linkage. The pneumatic mechanism is provided with electrical devices to ensure that the scraper cannot be dropped into its operative position until the speed of the basket has dropped to the safe discharging speed and also to ensure that the basket canot be accelerated to high speed until the scraper is at its rest position outside the basket. An adjustable damper is provided to control the speed of the scraper up to the end of its stroke, and the scraper is also provided with a bearing roller to prevent its edge from impinging against the



inner surface of the basket. The blade carries a baffle at its bottom end to direct the ploughed-off sugar to the outlets at the bottom of the basket, and a handle is fitted to the scraper blade support to permit manual operation if necessary.

TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Leyland Fleet for Bulk Sugar Haulage. Leyland Motors Co. Ltd., Leyland, Lancs.

By purchasing a fleet of Leyland Hippo articulated outfits, Mossman Central Mill Co. Ltd. of Queensland has become the first mill in this Australian State to transport its own sugar.

Previously employing road and sea transport, the company is now using its seven new Hippo tractors illustrated in conjunction with seven specially designed freighter trailers to transport bagged sugar by road from the Mossman mill to the harbour in Cairns. The four-axled trailers, built by Freighter Industries (Qld.) Pty. Ltd., have a capacity of 20 tons and can carry up to 288 bags of sugar. These are loaded and unloaded in pallets of 24 bags by fork-lift trucks in a matter of minutes.

The Leyland outfits are scheduled to complete two round daily journeys of 96 miles each between 8 a.m. and 5 p.m. To maintain this schedule each Hippo tractor has a powerful Leyland O.680 diesel engine driving through a step-up auxiliary gearbox and a double drive bogie with a ratio of 6·5 to 1.

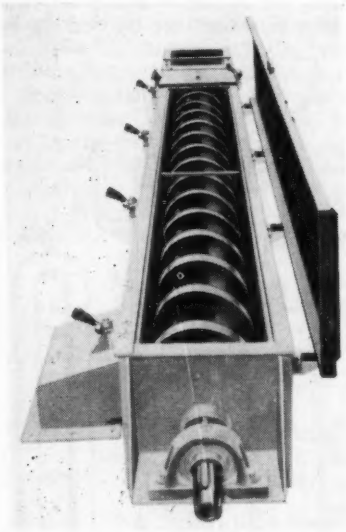
Although a Leyland field engineer accompanied the convoy of vehicles on its initial run to instruct the Mossman mill staff on maintenance and operation, no attention was required to the outfits during the 1300-mile road journey from Brisbane.

* * *

Scott-Rietz "Thermascrew". George Scott & Son (London) Ltd., Artillery House, Artillery Row, London S.W.1.

The "Thermascrew" is basically a true heat exchanger, consisting of a hollow screw mounted on a hollow shaft rotating at slow speeds in a jacketed trough or pipe. The heating or cooling medium is circulated through the hollow portions, while the material passes through the "Thermascrew," contacting both jacketed trough and screw.

In batch operations, the unit functions as a jacketed kettle or ribbon mixer with a hollow single or double screw rotor, whose special construction allows for a maximum heat transfer surface. The "Therma-



screw" may be fitted for vacum drying and evaporating or with a supplementary area for dry heating or cooling. Scott-Rietz "Thermascrews" are suitable for multipass operations and are constructed of steel or stainless steel.

Two units installed at Holly Sugar Corporation, Alvarado, Calif., U.S.A., transfer sugar from the dryer to a storage bin at a rate of approximately 6 tons per hour, cooling it from 54° to 35°C. Water at 20°C is passed through the screws and jackets. No crystal abrasion is apparent, and caking in storage is prevented.

* * *

Lighting the Mackay Bulk Sugar Terminal. Benjamin Electric Ltd., Tottenham, London N.17.

For the lighting of the Mackay storage shed described in our July 1958 issue, Benjamin High Bay reflectors, as illustrated, are equipped with 1000-watt G.L.S. lamps and arranged in groups of four at 73½ ft centres along the conveyor platform in the apex of the roof. Maintenance of the reflectors can easily be carried out from the platform and, with the mounting height of 73½ ft above the floor, a uniform

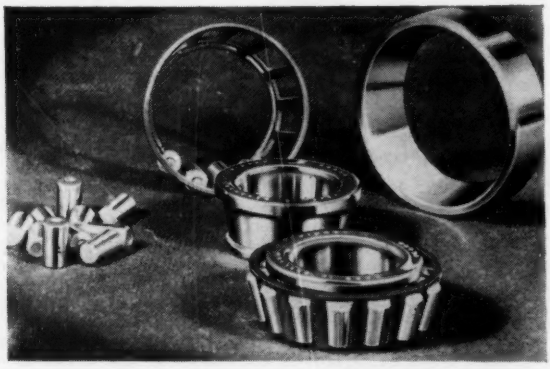
illumination is obtained over the whole area. Some contribution is made to the well-brightened environment of the shed interior by interreflection of the light by the mound of raw sugar, and there is a complete absence of "tunnel" effect.

Forty Benjamin Parabolic Angle reflectors are located at 24½ ft centres along each side to provide local lighting and can be operated in groups when required. The Benjamin lighting fittings were supplied by the British General Electric Co. (Pty.) Ltd., of Sydney.

* * *

Taper Roller Bearings. British Timken Ltd., Duston, Northampton.

British Timken Ltd. are one of the world's largest manufacturers of tapered roller bearings which are used throughout industry—in aircraft, agricultural machinery, road and rail transport, machine tools, steel rolling mills, conveyors, etc. In the sugar



industry, more specialized applications have been in the turntables and conveyors of silos and on the wormwheel and vertical shafts of automatic bag packers. As shown in the illustration, the bearings are in four parts: the inner race or cone, the rollers, the cage which holds the rollers in position, and the outer race or cup. All but the cage are made, with a few special exceptions, of a nickel enriched high alloy steel, case-hardened by charcoal or gas carburising to give a hard, wear-resisting surface over a tough, shock-resistant core.

The tapered roller bearing combines the ability to carry both radial and thrust loads by use of rolling elements with conical surfaces which meet at a common apex. The rollers are held square by a slight pressure deriving from the small angularity of the rolls; this permits the use of long rollers and consequent greater load-carrying capacity and longer life than other types of bearing.. The bearings are made in a wide range of types and sizes with different angles for different types of application, and range up to 7½ ft in diameter and 4½ tons in weight. Careful checking maintains an accuracy of less than 0·001 inches while specially selected precision bearings are accurate to within a fraction of a "thou". The large bearings are made in comparatively small batches at the Daventry factory of British Timken, while a remarkable, automatic factory at Duston produces the smaller bearings in large quantities.

* * *

PUBLICATIONS RECEIVED

PRECISION STEEL ROLLER CHAINS AND SPROCKETS. Link-Belt Company, Prudential Plaza, Chicago 1, Ill., U.S.A.

Book 2657 is a new 154-page engineering data book covering the selection, application, installation, lubrication and maintenance of roller chains and sprockets for drives and conveyors. Also described are chain casings, leaf chains, and flexible couplings and a guide is given to applications of corrosion-resistant stainless steel and bronze roller chains. Specifications of all Link-Belt chains are presented, and the roller chain's versatility illustrated in a wide range of applications.

* * *

AUTO FILTERS. A. & W. Smith & Co. Ltd., 21 Mincing Lane, London E.C.3.

Advantages of these filters emphasized in a new illustrated leaflet are: low operating and maintenance costs, efficient automatic sluicing, high filtration rates, visible filtrate from each leaf, even deposition of solids, minimum cleaning time and sluice water, maximum solids in sludge, automatic unloading of solids, no mechanical wear on cloths, and cleaning of cloths without removal. The filters are built in various sizes up to 1260 sq. ft. filtering area.

* * *

RENOLD PRODUCTS. Renold Chains Ltd., Manchester.

The range of Renold products is illustrated and described in a new booklet which shows chains of various pitches and types—precision, bush, cranked link, etc.—chains, wheels and attachments for mechanical handling, chaincases, autoadjusters, lubricators, tools, couplings and clutches, etc.

* * *

NEWS FROM D.d.S. A.B. De danske Sukkerfabrikker, Langebrogade 5, Copenhagen, Denmark.

In a small brochure are descriptions of the D.d.S. pan microscope for observing development of massecuites from grain formation to completion of boiling; the humidity tester which gives the moisture content of sugar (between 0·025 and 0·08%) based on the natural angle of repose which it takes up; and the D.d.S. micro-filter for measurement of the F_k values of prelimed and saturated juices.[1]

[1] See *I.S.J.*, 1950, **52**, 200.

SUGAR CROPS OF THE WORLD

WILLETT & GRAY'S CROP ESTIMATES†

(1) CANE SUGAR

	Harvesting Period	Long Tons		Short Tons		Metric Tons	
		1957/58	1956/57	1957/58	1956/57	1957/58	1956/57
United States—Louisiana	Oct.–Jan.	355,037	385,379	397,641	431,624	360,735	391,564
Florida	Dec.–Apr.	121,748	115,178	136,358	129,000	123,702	117,027
Puerto Rico	Jan.–June	834,000	883,946	934,080	990,021	847,386	898,133
Hawaiian Islands	Jan.–Dec.	732,000	970,536	819,840	1,087,000	743,749	986,113
Virgin Islands	Jan.–June	8,900	13,390	9,968	14,997	9,043	13,605
Cuba	Jan.–June	5,689,500	5,581,640	6,372,240	6,251,436	5,780,816	5,671,225
British West Indies—							
Trinidad	Jan.–June	184,035	167,805	206,119	187,942	186,942	170,500
Barbados	Jan.–June	152,500	204,525	170,800	229,068	154,948	207,808
Jamaica	Jan.–June	341,163	370,975	382,103	415,492	346,639	376,929
Antigua	Feb.–July	22,200	31,670	24,864	35,470	22,556	32,178
St. Kitts	Feb.–Aug.	42,500	44,376	47,600	49,700	43,182	45,088
Other B.W.I.	Jan.–June	12,479	12.871	13,976	14,416	12,679	13,078
French West Indies—							
Martinique	Jan.–July	88,500	68,675	99,120	76,917	89,920	69,777
Guadeloupe	Jan.–July	125,000	115,634	140,000	129,510	127,006	117,490
Dominican Republic	Jan.–July	891,964	725,000	999,000	812,000	906,280	736,636
Haiti	Dec.–June	50,000	62,500	56,000	70,000	50,803	63,503
Mexico	Dec.–June	1,200,000	1,033,125	1,344,000	1,157,100	1,219,260	1,049,707
Central America—							
Guatemala	Jan.–June	61,000	62,000	68,320	69,440	61,979	62,995
Salvador	Nov.–Mar.	48,000	40,000	53,760	44,800	48,770	40,642
Other Central America	Jan.–June	95,000	100,000	106,400	112,000	96,525	101,605
South America—							
British Guiana	Oct.–June	295,000	285,000	330,400	319,200	299,735	289,574
Colombia	Oct.–June	265,000	265,000	296,800	296,800	269,252	269,252
Venezuela	Oct.–June	158,000	198,586	176,960	222,416	160,536	201,773
Ecuador	June–Jan.	75,000	71,000	84,000	79,520	76,204	72,140
Peru	Jan.–Dec.	730,000	696,600	817,600	780,192	741,717	707,780
Argentina	May–Oct.	691,964	649,907	775,000	727,896	703,070	660,338
Brazil	June–May	2,645,783	2,212,255	2,963,277	2,477,726	2,688,248	2,247,762
Other South America	Jan.–Dec.	115,000	99,000	128,800	110,880	116,846	100,589
Total America		16,031,273	15,466,573	17,955,026	17,322,562	16,288,575	15,714,811
India and Pakistan (Gur)	Dec.–May	3,600,000	3,613,200	4,032,000	4,046,784	3,657,780	3,671,192
do. (White)	Oct.–July	2,500,000	2,200,000	2,800,000	2,464,000	2,540,125	2,235,310
Indonesia	May–Nov.	785,000	807,041	879,200	903,886	797,599	819,994
Japan	Nov.–June	111,334	86,107	124,694	96,440	113,120	87,489
Taiwan (Formosa)	Nov.–June	915,053	818,854	1,024,859	917,116	929,740	831,997
Philippine Islands	Nov.–June	1,197,672	1,020,500	1,341,393	1,142,960	1,216,895	1,036,879
Total Asia		9,109,059	8,545,702	10,202,146	9,571,186	9,255,259	8,682,861
Australia	June–Nov.	1,291,863	1,207,413	1,446,887	1,352,303	1,312,598	1,226,792
Fiji Islands	June–Nov.	197,000	134,500	220,640	150,640	200,162	136,659
Total Australia and Polynesia		1,488,863	1,341,913	1,667,527	1,502,943	1,512,760	1,363,451
Egypt	Jan.–June	300,000	250,000	336,000	280,000	304,815	254,013
Mauritius	June–Jan.	562,003	552,576	629,443	618,885	571,023	561,445
Reunion	Aug.–Jan.	190,000	190,000	212,800	212,800	193,050	193,050
Natal and Zululand	May–April	855,000	757,719	957,600	848,645	868,722	768,880
Mozambique	May–Dec.	158,000	149,500	176,960	167,440	160,536	151,899
Angola	May–Oct.	60,000	57,500	67,200	64,400	60,963	58,423
British East Africa	Sept.–Aug.	175,000	125,000	196,000	140,000	177,809	127,006
Total Africa		2,300,003	2,082,295	2,576,003	2,332,170	2,336,918	2,115,716
Europe—Spain	Dec.–June	25,000	32,000	28,000	35,840	25,401	32,514
Total Cane Sugar Crops		**28,954,198**	**27,468,483**	**32,428,702**	**30,764,701**	**29,418,913**	**27,909,353**

† Dated : 28th August, 1958.

SUGAR CROPS OF THE WORLD

(*continued*)

(2) BEET SUGAR

	Harvesting Period	Long Tons		Short Tons		Metric Tons	
		1957/58	1956/57	1957/58	1956/57	1957/58	1956/57
Europe—Germany	Sept.–Jan.	2,323,000	1,719,046	2,601,760	1,925,332	2,360,284	1,746,637
Czechoslovakia	Sept.–Jan.	740,000	659,000	828,800	738,080	751,877	669,577
Hungary	Sept.–Jan.	270,000	296,138	302,400	331,675	274,334	300,891
France	Sept.–Jan.	1,540,000	1,424,444	1,724,800	1,595,377	1,564,717	1,447,306
Belgium	Sept.–Jan.	383,000	320,114	428,960	358,528	389,147	325,252
Holland	Sept.–Jan.	395,000	358,300	442,400	401,295	401,340	364,051
Russia and Ukraine	Sept.–Jan.	4,911,000	4,778,000	5,500,320	5,351,360	4,989,822	4,854,687
Poland	Sept.–Jan.	1,042,000	862,000	1,167,040	965,440	1,058,724	875,835
Sweden	Sept.–Dec.	325,000	293,056	364,000	328,222	330,215	297,760
Denmark	Sept.–Jan.	375,000	344,680	420,000	386,042	381,019	350,212
Italy	Aug.–Oct.	877,000	1,006,111	982,240	1,126,844	891,075	1,022,258
Spain	July–Feb.	320,000	400,448	358,400	448,502	325,136	406,875
Switzerland	Sept.–Jan.	37,500	33,770	42,000	37,822	38,102	34,312
Bulgaria	Sept.–Jan.	110,000	118,889	123,200	133,156	111,766	120,797
Roumania	Sept.–Jan.	182,000	150,000	203,840	168,000	184,920	152,408
Great Britain*	Sept.–Jan.	554,000	689,671	620,480	772,432	562,892	700,740
Eire*	Sept.–Jan.	119,000	95,000	133,280	106,400	120,910	96,525
Jugoslavia	Sept.–Jan.	250,000	165,216	280,000	185,042	254,013	157,868
Turkey*	Sept.–Jan.	330,000	346,053	369,600	387,579	335,297	351,607
Other countries	Sept.–Jan.	340,000	310,000	380,800	347,200	345,457	314,975
Total Europe		15,423,500	14,369,936	17,274,320	16,094,328	15,671,047	14,600,573
United States—Beet*	July–Jan.	1,818,482	1,665,480	2,036,700	1,865,338	1,847,669	1,692,211
Canada—Beet*	Oct.–Dec.	120,000	111,711	134,400	125,116	121,926	113,504
Total Beet Sugar Crops		**17,361,982**	**16,147,127**	**19,445,420**	**18,084,782**	**17,640,642**	**16,406,288**
Grand Total—Cane and Beet		**46,316,180**	**43,615,610**	**51,874,122**	**48,849,483**	**47,059,555**	**44,315,641**

* Refined Sugar.

BREVITIES

Industrial Use of Bagasse in Puerto Rico.[1]—According to information received from the Director of Industrial Research of Puerto Rico, a start will soon be made with the industrial utilization of bagasse. A factory is already being built at Arecibo for the manufacture of corrugated cardboard and packaging material from this raw material. The cost of the factory is estimated at $8 million. Moreover, plans are being made for the building of a factory for the manufacture of fibre boards, also from bagasse, and an amount of 4·5 million dollars will be invested.

* * *

Pulp and Paper Machinery for Colombia.[2]—A credit of $5·7 million has been granted by the Export-Import Bank to Pulpay Papel Colombianos S.A., a subsidiary of W. R. Grace & Co. which will construct and equip a new plant for the manufacture of good quality paper for writing and printing, and also for wrapping purposes for the Colombian market. This production will save foreign currency equivalent to approximately U.S. $5,000,000 annually on imports of paper. Pulpay Papel Colombianos will use pulp made from sugar cane bagasse. Its new plant will be located near the city of Cali and the bagasse will be obtained from the factories located in the Cauca valley. The new plant will have a production capacity of 85 metric tons of pulp per day, and 65 metric tons of paper. W. R. Grace & Co., founded in Peru 104 years ago, has been producing paper from bagasse in that country for more than 15 years.

[1] *Economische Voorlichting*, 25th July 1958, p. 21.
[2] *La Industria Azucarera*, 1958, **44**, 351.

New Sugar Factory for Angola.[3]—According to press reports a licence has been granted for the erection of a new sugar factory in Angola. It is said to have a processing capacity of 7000 tons a day.

* * *

International Sugar Conference.—At the time of going to press, the International Sugar Conference, held under the auspices of the United Nations Organization, was due to take place on and from the 22nd September. The Conference will discuss and negotiate the extension of the International Agreement for a further five years and it is hoped, of course, that as wide a range of countries as possible will accede, so that the free market supplies and requirements can be mutually regulated to the benefit of all concerned.

* * *

Puerto Rico Crop, 1958.[4]—The 1958 sugar crop in Puerto Rico was completed on 3rd August with an out-turn of 934,000 short tons, raw value. This represents a reduction of 56,000 short tons from last year's crop of 990,000 tons. Owing to the extreme drought of the past year and the low yield of sucrose, the crop had suffered considerably. The adjusted quota for supply to the U.S. market has been adjusted by the U.S. Dept. of Agriculture to 815,000 tons, although Puerto Rico could ship an amount up to its present share under the current quota, namely, 1,140,253 tons, if it had the sugar to do so.

[3] F.O. Licht, *International Sugar Report*, 1958, **90**, (Supp.17), 13.
[4] *Lamborn*, 1958, **36**, 180.

BREVITIES

Cuban Production 1957/58.[1]—Sugar production in Cuba for 1958 is reported at 6,542,719 short tons, raw value.

* * *

International Sugar Agreement Quotas.—The U.S.S.R., acting under Article 11 of the Agreement, has surrendered her 200,000 metric tons quota which has accordingly been distributed to other exporting members who are assumed to be able to meet the deficit. France, Haiti and the Netherlands have previously surrendered their quotas so that the revised quotas are as follows:—

Belgium	57,928	metric	tons
China (Taiwan)	689,866	,,	,,
Cuba	2,593,533	,,	,,
Czechoslovakia	314,638	,,	,,
Dominican Republic ..	689,866	,,	,,
Hungary	50,157	,,	,,
Indonesia	350,000	,,	,,
Mexico	78,992	,,	,,
Philippines	25,000	,,	,,
Poland	220,000	,,	,,
	5,070,000	,,	,,

Subsequently, however, Indonesia is reported[2] to have surrendered her 350,000-ton quota and this will be re-allocated to other countries.

Stock Exchange Quotations

London Stocks (*at 18th September* 1958)

	CLOSING MIDDLE
Anglo-Ceylon (5s)	13/9
Antigua Sugar Factory (£1)	21/3
Booker Bros. (10s)	21/7½
British Sugar Corp. (Ltd. (£1)	17/–
Caroni Ord. (2s)	4/9
Caroni 6% Cum. Pref. (£1)..	17/–
Distillers Co. Ltd. (6s. 8d units)	26/4½
Gledhow Chaka's Kraal (£1)	60/–
Hulett & Sons (£1)	73/–
Jamaica Sugar Estates Ltd. (5s units) ..	6/3
Leach's Argentine (10s units)	9/9
Reynolds Bros. (£1)	48/–
St. Kitts (London) Ltd. (£1)	51/3
Ste. Madeleine (Ord.) (£1)	25/6
Sena Sugar Estates (10s)	27/3
Tate & Lyle (£1)	62/6
Tate & Lyle Investments Ltd. (5s)	13/6
Trinidad Sugar (5s stock units)	12/6
United Molasses (10s stock units)	32/9
West Indies Sugar Co. Ltd. (£1)	28/3

New York Stocks (*at 17th September* 1958)

	CLOSING MIDDLE $
American Crystal ($10)	41
Amer. Sugar Ref. Co. ($100)	33½
Central Aguirre ($5)	19¼
Cuban American ($10)..	30⅛
Great Western Sugar	28⅞
South P.R. Sugar	26½
United Fruit Co.	48
West Indies Sugar Corp. ($1)	59½

Norway–Poland Trade Agreement.[3]—Under the terms of an agreement signed in Warsaw on 17th June, Poland will supply Norway with 20,000 tons of sugar in the year ending April 1959.

* * *

Italy–Morocco Trade Agreement.[4]—Under the terms of an agreement signed in Rome on 24th June, Italy is to export to Morocco 10,000 tons of sugar during the year ending June 1959.

* * *

Peru Sugar Exports.[5]—Sugar exports in 1957 set a record—496,272 metric tons compared with 428,303 in 1956. Production was down from 717,000 tons in 1956 to 708,000 tons in 1957, both figures including those for chancaca. Japan became Peru's principal customer, replacing Chile; however, Peru continued to be Chile's principal supplier. Sugar exports to the U.S.A. increased slightly; other important customers were the U.K., Germany, Bolivia and Uruguay.

* * *

Corrigendum.—On page 195 of our July 1958 issue the equation at the top of column 2 should read

$$S = \sqrt{K}\,\frac{e\sqrt{e}}{(1-e)}\,\sqrt{T}$$

* * *

Bulk Handling in Queensland.[6]—The new £2 million Bundaberg port and bulk sugar terminal which was not scheduled for completion until the end of January will commence operations within a few weeks. This "speed up" is expected to result in a saving of at least £250,000 because the terminal will be able as a consequence to handle this season's sugar crop in the Bundaberg area.

* * *

Eire Beet Campaign, 1957/58.[7]—At the Annual General Meeting of the Irish Sugar Co. Ltd., the Chairman mentioned that the 21% increase in area sown to beet compared with the previous year had led to a 27% increase in the tonnage delivered. As a result of lower purities and lower extraction, however, sugar outturn was only 22% higher. Total white sugar production was 108,414 tons (88,646 tons in 1956) from 794,802 tons of beet (626,422) harvested from 70,923 acres (58,604).

* * *

Iraq Factory Tender.[8]—Tenders have been invited until 21st October 1958 by the Development Board and Ministry of Development of the Government of Iraq for the supply, erection and supervision of operation of a complete beet sugar plant, including civil engineering work and related power station. The plant, located near Sulaimanigah in Northern Iraq, is to have a processing capacity of 2000 tons of sugar beet per day.

* * *

The Albanian Sugar Industry.[9]—The centre of sugar beet cultivation is the district of Korca (Koriza) where the only sugar factory is situated. Malik factory, founded in 1938 by Italian manufacturers, was put into operation after World War II and has a capacity of 14,000 tons of sugar a year although only 9000–11,000 tons are produced, covering domestic requirements. The acreage planted to beet has increased from 1300 ha in 1948 to 5500 ha in 1956 and is irrigated in part. The sugar yield fluctuates between 2·5 and 3·1 tons/ha. Beet seed is imported from the U.S.S.R. and equipment for mechanization of beet cultivation is also imported from the U.S.S.R. and Bulgaria.

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[1] *Sugar y Azúcar*, 1958, **53**, (9), 28.
[2] *Public Ledger*, 13th September 1958.
[3] C. Czarnikow Ltd., *Sugar Review*, 1958, (368), 144.
[4] C. Czarnikow Ltd., *Sugar Review*, 1958, (368), 145.
[5] *Foreign Trade*, 1958, **110**, (5), 13.
[6] *Queensland News Letter*, 4th September 1958.
[7] C. Czarnikow Ltd., *Sugar Review*, 1958, (367), 140.
[8] *Willet & Gray*, 1958, **82**, 326.
[9] *Zeitsch. Zuckerind.*, 1958, **83**, 410.